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the OIL AND GAS JOURNAL

PUBLISHED WEEKLY JULY 13, 1959

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Atomic wastes may help oil men ▸ 72

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CO boiler adds to steam supply ▸ 138

How many gas strikes pay off? ▸ 176

Special 16-page Report

PIPELINE COSTS

They vary all over the map! p. 89

WATCH OPERATING CYCLE COSTS DROP WITH CAMERON GATE VALVES

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The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
July 13, 1959

Rumors persist in Washington of gas-tax compromise:

Word is that Democratic leaders are considering a temporary increase of ½ or 1-cent a gallon in the federal levy for 1 year.

Eisenhower has indicated he will accept the smaller increase after losing his bid for a 1½-cent levy.

The 1-cent tax hike would bring in about $482 million this year. That's nearly enough to offset the anticipated $500-million deficit in the highway trust fund.

If Eisenhower gets the smaller tax increase, he's expected to ask that the highway building program be extended 2 years beyond its present expiration date.

That points up the real danger: There's nothing more permanent than a temporary tax (more details, p. 71).

Air Force and AEC have awarded $5.3-million contract to Martin Co., Baltimore, for an atomic plant to power military electronic equipment and to heat barracks, other buildings.

It will be composed of factory-assembled units which can be dismantled, flown to a remote site, and quickly reassembled. Plant will be installed at Air Force radar station near Sundance, Wyo.

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Russians are spending a lot of effort developing a first cousin to their turbodrill. It's an electric drill operated by a high-powered, down-hole motor.

The drill pipe remains stationary. The down-hole motor gets its power from an electric cable built into the drill pipe (OGJ, June 8, p. 104).

How widely electric drills are being used in Russia is a secret. Basic data, however, have been released on seven different models. One of the drills has made 3,717 ft. of hole in 97 hours in an experimental test in Karadag field, near Baku.

Advantages claimed by the Russians: Electrodrills can be used with heavy and high viscosity muds. They also permit reverse circulation of mud.

Sealed-bearing bits should be ready for the market about the end of the year.

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They've already been field tested in fast-drilling areas of South Louisiana and hard-rock areas of West Texas. Contractors predict a reliable sealed-bearing bit will enable them to carry heavier weights on their bits. It would mean faster drilling, longer runs in areas where bearings wear out before teeth do.

Sealed-bearing design also looks promising for insert-type bits.

Look for drilling in the Neutral Zone to pick up soon.

Getty Oil, which holds a concession covering an undivided half interest in the Neutral Zone, has bought a used Hopper slim-hole rig from Gene Reid Drilling Co., Bakersfield, Calif. It is now being moved to the zone.

A likely drilling location: The northwest corner of the zone just across the Kuwaiti border from Kuwait Oil Co.'s recent 1,660-bbl. discovery at Mina Gish (OGJ, June 1, p. 114).

General Petroleum has taken on a tough drilling job in Alaska.

It has spudded the first wildcat near Beacharof Lake on the Alaskan Peninsula. It's the first venture planned under a 455,573-acre development contract approved earlier this year by the Interior Department (See p. 64).

A new field has been added to the Ordovician play in Southern Michigan (p. 175).

Indicated success at the Bell & Gault 1 Bissell is the first in a possible new trend parallel to the prolific Scipio-Pulaski-Albion belt of production. Result is a new wave of leasing in the region.

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Radioactive wastes may become the top secondary recovery tool of the future.

Tests now indicate this possibility: Fluid wastes may be injected into an abandoned gas reservoir, sealed, and then forgotten for 30 years. It may then be reopened and operated as a commercial condensate field.

That's the prediction of Dr. George Crawford, University of Texas scientist, who has made exhaustive studies of the proposition. (Full details on p. 72).

Atlantic's highly successful miscible-displacement method of increasing oil recovery is now available to the oil industry generally.

Atlantic has named the James A. Lewis Engineering Co. of Dallas as agent to license the patented high-pressure gas-injection process.

Atlantic technicians estimate the process is applicable to 5% of domestic reserves (p. 66).

Oklahoma's last dry county in the Anadarko basin may soon have a producer.

Magnolia Petroleum has a possible strike at a deep wildcat in Roger Mills County in western Oklahoma, 15 miles northwest of Cheyenne. It is the 1 Young which topped the Red Fork or its equivalent Pennsylvanian sand at 11,562 ft.

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Geophysical activity in foreign areas is on upswing. SEG survey shows number of American geophysical personnel in foreign operations has almost doubled in last 3 years.

College students majoring in geophysics are having little trouble finding jobs—but it isn't as easy as couple of years ago when they were being hired while in their junior year. Most of the current crop are being placed as seniors or after graduation.

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Northern Natural Gas is showing increased interest in building a line from Canada to U. S. markets.

Company's producing subsidiary for years has had offices in Calgary and Billings, Mont., for leasing and exploration.

Parent company's gas-supply department recently also opened offices there to investigate possibility of obtaining additional sources of gas supplies.

Less than half of so-called "successful" gas discoveries in the U. S. result in reserves considered profitable.

That's the conclusion of recently-completed study of gas wildcatting over 10-year period by AAPG's committee on statistics of exploratory drilling. It's the committee's first attempt to analyze natural-gas reserves resulting from successful new field wildcat completions.

The study covers discoveries from 1943 to 1953, with reserve estimates as of Jan. 1, 1959. It shows:

...Only 45.5% of discoveries during 10-year period were profitable. The committee considered 6 billion cubic feet of reserves as breaking point between profitable and unprofitable.

...Three out of four strikes made during 1953 were unprofitable.

...Average of 27.9% of all successful wells (oil and gas) during 7-year period were gas wells.

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Note to refiners:

Here's way to combat hydrogen blistering. Add alkyl pyridine to your process steam.

Union Carbide reports that 50 p.p.m. of the chemical added

to a solution of 5% sodium chloride and 900 p.p.m. hydrogen sulfide effectively stopped both corrosion and hydrogen blistering of a steel probe immersed for 7 days.

Hydrogen attack results in blistering and weakening of process equipment due to penetration of the light gas into the metal.

Many failures of critical vessels have been marked down to hydrogen blisters. Need for means to curtail the attack is especially important in light of tremendous cat reforming capacity and hydrogen treating unit capacity now installed.

Only one basic issue is involved in current rash of strikes: Who's going to run the refineries?

OCAW wants more control over manning and job assignments in the plants. Management appears determined now to regain control over work practices in their plants.

Shutdowns at present have left 2,383 men out of work and shut off about 230,000 bbl. daily of refining capacity. Loss to producers is running about $890,000 daily with workers losing about $193,000 weekly (p. 61).

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Five Japanese companies have joined to design a 60,000-ton nuclear-powered tanker. Cost is estimated at $14,110,000 against about $10 million for a conventional ship of similar capacity.

Dimensions would be 815-ft. long, 110-ft. wide with top speed of 17.5 knots. Design has been completed but construction plans still are indefinite.

Central Railroad of New Jersey is spraying its bridges with an asphaltic oil instead of painting them.

It means considerable saving in cost. Oil costs 21 cents per gallon against $2.85 for paint. One oil coat suffices against two of paint. Life expectancy of each job is 10 to 12 years. The oil coat dries into hard black mirror-like finish.

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Importers have cleaned up all the old balances remaining on second-quarter quotas. During the week ended July 3, they also made a good start on quotas for the current quarter.

That's the explanation for the week's lopsided statistics when total imports averaged 1,990,800 bbl. daily, including 1,473,300 bbl. daily of crude.

Most of the week's total came during the June portion, which included only 5 days. Average for these days was 2,263,100 bbl. For the two full days in July, the average was 1,310,300 bbl.

Good Wells Make Good News

Recent Treatments Engineered With the Aid of the "Frac Guide"

July 13, 1959

The "Frac Guide*" -- a Dowell-developed manual used in engineering frac jobs -- is revolutionizing fracturing techniques. Here are four recent treatments that show improved results obtained with the "Frac Guide."

- **Atascosa County, South Texas** (Old Oil Well) This well was completed into the Navarro formation at 5043 feet. After production had dropped to almost nothing, the well was refractured. 15,000 gallons of lease crude and 30,000 pounds of sand failed to help. Then Dowell engineered a treatment with the "Frac Guide." Riverfrac* was selected as the frac service; and 100,000 gallons of fresh water and 100,000 pounds sand were injected down casing, creating a calculated fracture area of 126,000 square feet. Production climbed to an average of 21 bopd and showed no sign of decline after 60 days. Treatment paid out in about 65 days.

- **Beaver County, Oklahoma Panhandle** (New Gas Well) This well, completed through perforations into the Lower Morrow sand at 7831-46 feet, tested 750,000 cfd open flow. Dowell engineers designed a treatment with the "Frac Guide" and recommended Waterfrac. 10,000 gallons of thickened water and 44,000 pounds sand were pumped into the well, creating a calculated fracture area of 50,000 square feet. After clean-up, production was 35 mmcfd on potential test. Other wells in the area, fractured with 20,000 gallons gelled oil and 20,000 pounds of sand -- the standard treatment in the Lower Morrow before the advent of the "Frac Guide" -- usually test only about 8 mmcfd.

- **Natrona County, Wyoming** (New Oil Well) This well produced only 16 bopd from the Second Wall Creek formation at 4256 feet. With the "Frac Guide", Dowell engineered a treatment using Sandfrac*. 38,000 gallons of lease oil with F.L.A.* (Fluid Loss Additive) and 105,000 pounds of sand were injected into the well. The calculated fracture area created was 123,000 square feet. Production 60 days after treatment was 65 bopd. Smaller jobs in this field, using only 1½ pounds of sand per gallon, usually result in only about 35 bopd.

- **Alberta, Canada** (Old Oil Well) Based on core analysis and previous experience, a major operator considered abandoning a well completed in the Cardium at about 4411 feet. Then Dowell engineered a treatment using the "Frac Guide", and injected 5000 gallons of 40 gravity lease crude carrying 25,000 pounds of sand down tubing. A calculated fracture area of 36,000 square feet was created. The operator feels certain that the well will now make its allowable; and that a commercial well could not have been obtained using previous fracturing techniques.

Let your Dowell engineer help you plan your next fracturing job. There is no additional cost. Contact the Dowell office or station nearest you. There are more than 165 locations in the United States, Canada, Venezuela and Argentina. Dowell, Tulsa 1, Oklahoma. *Dowell Trademark.

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TECHNOLOGY—OPERATION

SPECIAL SECTION: PIPELINE COSTS 89-104
By Paul Reed and Gene Kinney

Oil-Line Operating Costs Drop 23% in 10 Years **90**
The advances of modern pipelining, particularly with respect to lines built during the past 10 years, have borne fruit in decreased unit operating costs. They have dropped from 32.2 to 24.9 cents per 1,000 bbl-miles in the period, 1948-1957.

Operating Costs of Gas Lines Have Increased **93**
Compressor-station costs have remained surprisingly stable for the period, 1952-57. Total operating expenses have increased steadily over the same period, while maintenance expenses have decreased slightly.

Rules of Thumb for Estimating Pipeline Costs **95**
Here are short-cut methods for making cost estimates. They have been selected from current pipeline practice, and apply to some of the principal items of materials, equipment, installation, maintenance, and operation.

Construction Costs Depend on Time and Place **97**
There are no average or typical construction costs. Each area requires a separate study. This applies to compressor stations as well as pipelines.

Wages, Equipment Follow National Pattern Upward **102**
Labor cost has risen 23 to 29% in the period, 1954 to 1959. Major equipment cost has increased 30.9% during the same period.

Pipelines Still Cheapest Overland Transportation **104**
A tabulation of typical crude and products rates.

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Locating Tomorrow's Chemical Plants . . **106**
By H. E. Wessel
The decade ahead will likely witness some sharp changes in the chemical industry. Chemical-market research will play an important part in plant design and location.

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Practical safety rules for dealing with pressure-relief devices.

Questions on Technology **133**

CO Boiler Supplements Refinery Steam Supply **138**
By H. H. Forgey and T. E. Kobett
Production of steam at minimum cost by burning the CO and making use of sensible heat in regenerator flue gases was the goal involved in the installation of an additional 250,000 lb. per hour of steam-generating capacity at Indiana Standard's Sugar Creek refinery.

Survey of CO Boiler Installations **143**

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Reservoir Engineering—11 . . . . . **112**
By E. T. Guerrero and F. M. Stewart
How to determine effective permeability.

Telemetering Aids Lease Operations for Shell **134**
By D. H. Stormont
The new data-collecting system gives the company much more information on producing operations in Brea-Olinda field near Los Angeles. Oil and gas daily rates from more than 200 wells are collected at seven trap farms. Oil is shipped through two LACT systems or manually shipped at two other points.

Drilling

Fluid-Loss Reducers for Clear Water **122**
By F. O. Jones and J. L. Lummus
Fluid-loss reducers have been developed which make clear water an excellent fluid for completing wells, reworking them, or cleaning them out. Here are case histories on six Texas and two Oklahoma wells.

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Norris Suggests:

Keep Clean Rods Clean

to Reduce Your Pumping Costs

Helpful Hints

- CLEAN JOINTS BEFORE DOPING. Don't "grease-in" dirt and foreign matter to cause thread and joint trouble later.
- KEEP TOOLS, EQUIPMENT, EVEN GLOVES, REASONABLY CLEAN. Avoid chance "planting" of dirt and abrasives. Good housekeeping *does* pay!
- KEEP DOPE BUCKETS AND BRUSHES PROTECTED. Avoid "mixing-in" dirt and dust.

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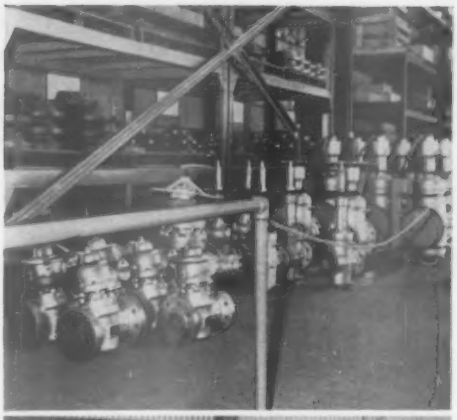

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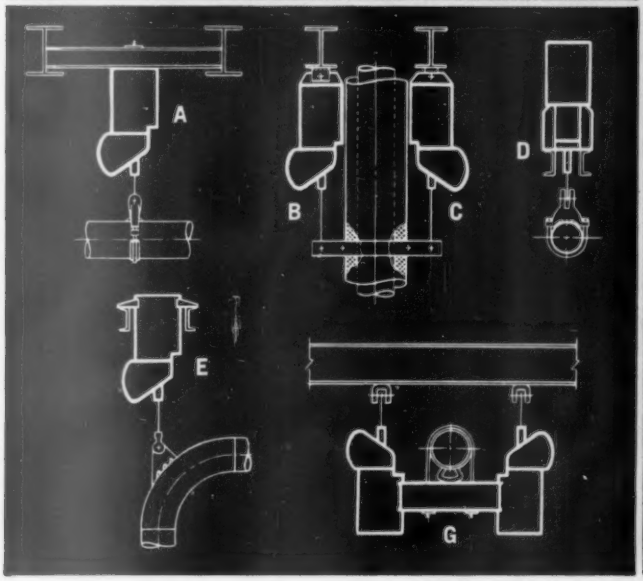

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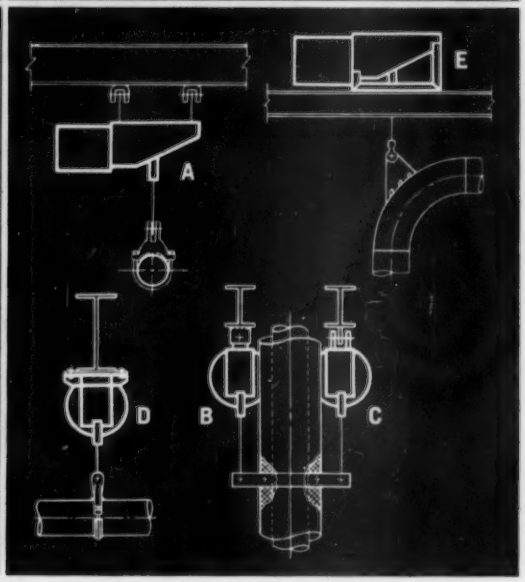

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HALLIBURTON PENETRATING ACID

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MCA is a first stage completion acid which can be used in all types of producing formations without the possibility of undesirable reaction products.

HALLIBURTON "HV" ACID

"HV" Acid derives its name from high viscosity. It retards the chemical reaction of acid on limestone formations allowing penetration of unreacted acid a greater distance from the bore hole.

Frequently "HV" Acid, carrying temporary bridging agents, is used as a diverting tool between stages of acid. It is especially useful in open hole work for temporarily plugging thief zones during treatment.

HALLIBURTON "Fe" ACID

This is regular penetrating acid containing a conditioning agent to minimize the undesirable effect of the re-precipitation of dissolved iron salts and oxides during acidizing.

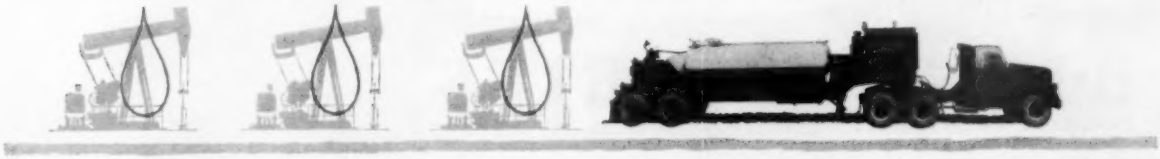
"Fe" Acid is best suited for conditions where abnormal amounts of iron are dissolved by acid prior to its spending on the formation. Such conditions as those associated with disposal and injection wells are instances of its usefulness.

Another use for "Fe" Acid is in producing wells for production improvement where the pipe has a thick coating of iron oxide or salts. Acid will dissolve these iron compounds regardless of the presence of any type of inhibitor used for pipe protection. This iron bearing acid, when spent, exposes flow channels to the plugging action of re-precipitated iron hydroxide. "Fe" Acid aids in preventing this.

HALLIBURTON CHEMICAL SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

"NEW LIFE FROM OLD OR STUBBORN WELLS-WITH ACIDIZING"



POSITIVE CONTROL OF MATERIALS IN MOTION B·I·F METERS FEEDERS CONTROLS

On Texas Eastern's
Little Big Inch . . .

Fast, Accurate B·I·F *Proportioneers*

Meter Accounting System Means . . .

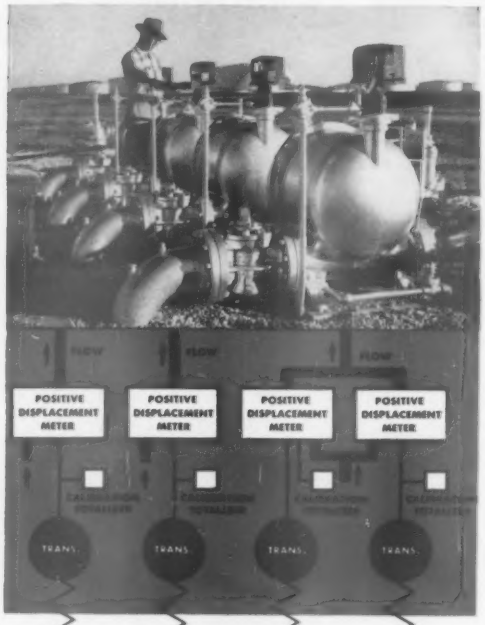
Calibrated accuracies to ±.02%!

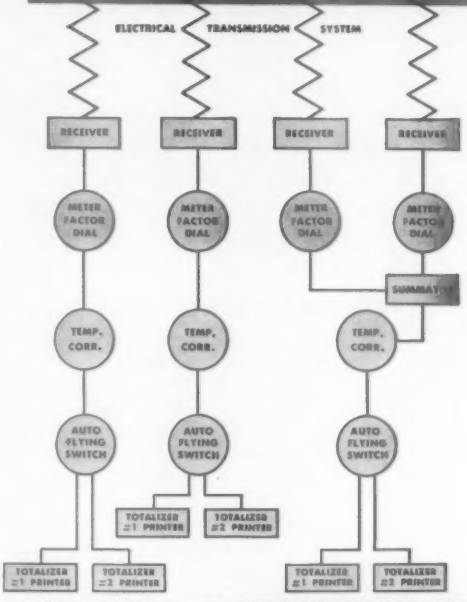
All read-outs automatically corrected for meter factor and temperature!

Human error eliminated . . . better quantity accounting of products delivered to and received from their shippers!

At stations along Texas Eastern's 1168 mile, 20-inch products pipeline, fully automatic integrating meter consoles print out summated quantities of products received and delivered through banks of PD meters. The Little Big Inch is capable of handling 185,000 BPD with speed and accuracy possible *only* with automatic equipment. Labor costs are reduced as Proportioneers Meter Accounting Systems streamline the entire products accounting phase of operation.

For fast, accurate, continuous pipeline accounting, investigate the addition of Proportioneers consoles to your existing meters.
For Bulletin SM-3280, write
B-I-F Industries, Inc., Dept. P,
377 Harris Avenue, Providence 1, R. I.





B·I·F

B-I-F INDUSTRIES
BUILDERS-PROVIDENCE · PROPORTIONEERS · OMEGA

Let's talk about EASE of operation!

IT WAS NORTHWEST that pioneered the movement in the direction of ease of Shovel and Crane operation back in the days when operators had to *stand* at the controls on other machines.

To maintain full day operator efficiency, Northwest engineers developed and pioneered the "Feather-Touch" Clutch Control. This device utilizes the power of the engine to throw the heavy Drum Clutches. Over the years the "Feather-Touch" Clutch Control has been refined and improved to a high point of efficiency.

Here, ease of operation is made possible by a simple, understandable, mechanical device—just a drum and brake band and the necessary linkage —nothing more. It is completely free of complicated and delicate mechanisms. There are no long lines of tubing, no pumps, no compressors or valves—nothing to fill! It is unaffected by weather or temperature and it requires no special knowledge or outside help for adjustment. The action of the clutch is in direct ratio to the movement of the operating lever and the operator does not have to maintain pressure on the operating lever to keep the clutch engaged. It is extremely sensitive and the *true feel of the load* is always present. Release is positive and straight manual control can be introduced at any time.

On a Northwest the operator knows where he is every second of his operating cycle. At once he has smooth, effortless control. This means greater accuracy and ease in setting loads around refinery and rigs. The "Feather-Touch" Clutch Control is pictured in detail in Northwest catalogs. We'll be glad to send you one on the size machine you need.

Ask about the 25-D ¾-yd. and the 18-ton Lifting Crane

Be sure to find out about the 25-D and the 25-D 18-ton Lifting Crane—New Independent High Speed Worm Boom Hoist, True Power Load Lowering, Longer, Wider Crawlers, Larger Drums and Greater Cable Capacity, Larger Drum Brakes and Clutches and many other advantages.

NORTHWEST ENGINEERING COMPANY
1513 Field Building, 135 So. LaSalle Street, Chicago 3, Illinois

NORTHWEST Always Ready to GO

XG-29-LGC

NORTHWEST EQUIPMENT IS BUILT IN THE FOLLOWING SIZES

SHOVELS	CRANES	DRAGLINES	PULLSHOVELS	TRUCK CRANES
¾ Yd. to 2½ Yd. Capacity	13-Ton to 50-Ton Capacity	¾ Yd. to 3 Yd. Capacity	¾ Yd. to 2½ Yd. Capacity	25-Ton and 35-Ton Capacity

NEW!

Humble THREDLOK

Stronger, Cheaper than tack-welding

THREDLOK 801 is a new compound that seals and locks casing joints tightly and permanently. It offers an easy, economical alternative to welding for bonding the bottom two or three joints in a casing string to prevent casing breakout during rotary drilling.

Extensive use in the field has proved that THREDLOK provides stronger joints than tack-welding. It eliminates the possibility of damage to high-strength casing that may result from welding alloy pipe. And where welding the first two or three joints in a casing string costs approximately $50 to $75, THREDLOK gets the job done for about $6.00.

THREDLOK 801 is available in pound cans, @ $3.00 per lb., at Humble wholesale plants throughout Texas and New Mexico. THREDLOK is also available through many oil field supply stores. Call the one nearest you, or phone or write:

Humble Oil & Refining Company
Consumer Sales, P. O. Box 2180
Houston 1, Texas

How to use

- Remove couplings, carefully clean and dry both male and female threads.
- Mix contents of THREDLOK can, pour converter into can and stir thoroughly.
- Apply THREDLOK to male and female threads with paddle or putty knife, making sure the threads are completely covered.
- Make the joint up immediately. It can then be run into the hole without delay.

HUMBLE

ASSEMBLY HERE

MEANS SAVINGS HERE

Continental-Emsco's
PRE-OVERSEAS RIG ASSEMBLY
. . saves costly time in isolated drilling areas

Prior to overseas shipment, careful, accurate and complete assembly and inspection is made of each piece of your equipment. After this thorough inspection, all parts fit and are ready for operation.

Inspection standards are uniform throughout all C-E manufacturing plants in U.S.A., France, England and Italy. Full responsibility is centered at each facility, so plant management is well aware of your needs. Delays for home office approval are eliminated . . modifications are quickly, inexpensively made.

This optional item-by-item assembly and inspection means C-E and related equipment is complete . . ready to perform . . with no profit-wasting delays . . even in remote drilling or producing fields.

For Service that Sings . . Equipment that Hums . . Go . .

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Serving the Oil and Gas Industries ... Worldwide

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Export Division: 30 Rockefeller Plaza, New York, N. Y. • Continental-Emsco Company Limited • General Offices: Calgary, Alberta, Canada
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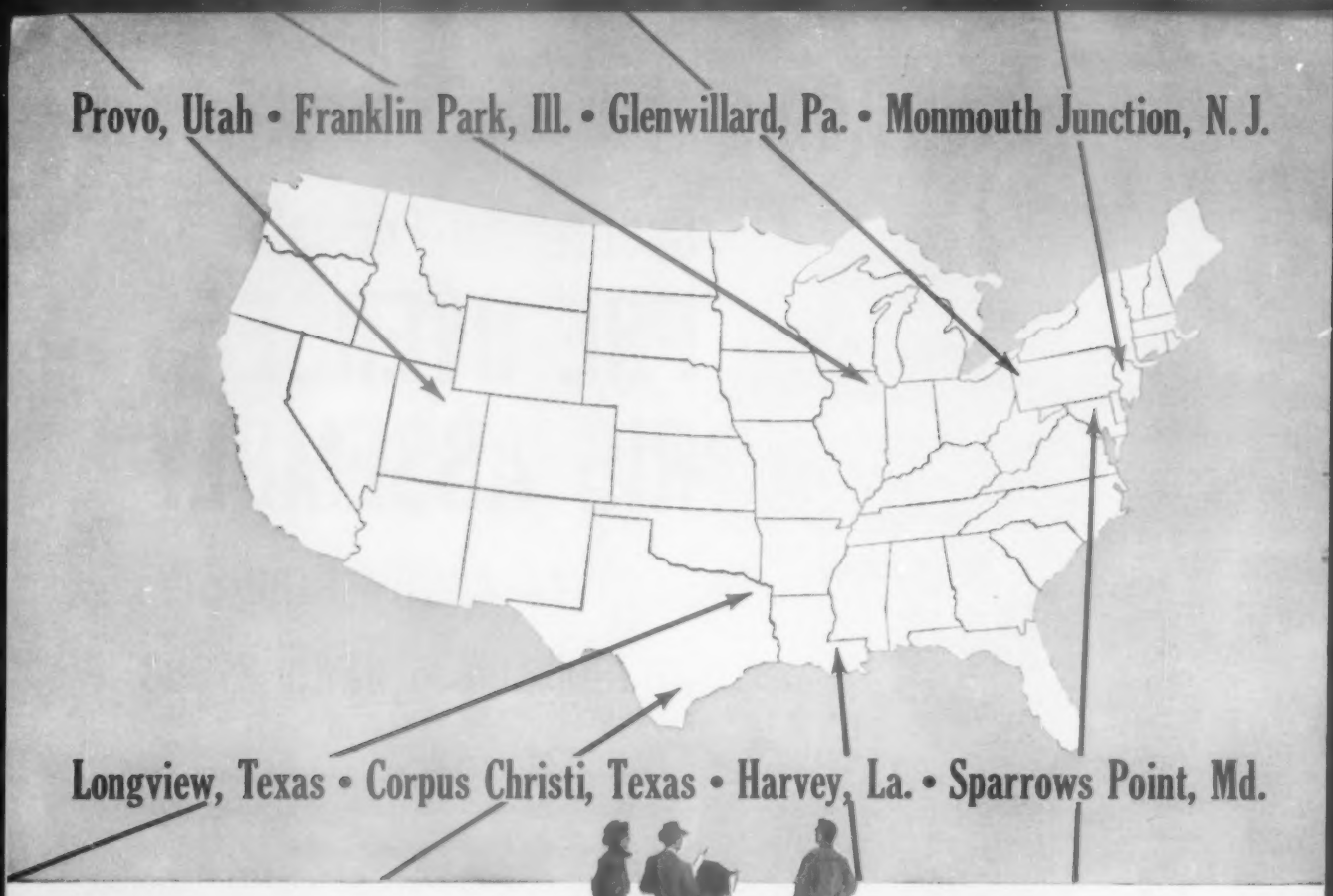
Representatives in All Principal Oil Fields of the World

IS 902

Provo, Utah • Franklin Park, Ill. • Glenwillard, Pa. • Monmouth Junction, N. J.



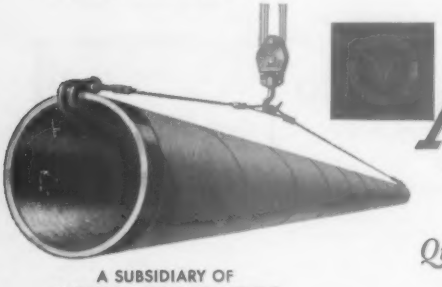
Longview, Texas • Corpus Christi, Texas • Harvey, La. • Sparrows Point, Md.

Sales offices at all plant locations . . . and Atlanta, Ga.; Dallas, Tex.; Houston, Tex.; Lincoln, Nebr.; Syracuse, N. Y.

Pipe Protection strategically located to save you time and money!

Pipe Line Service has eight fully equipped wrapping plants to serve the major steel pipe producing areas in the country! These eight modern plants are strategically located to serve you as the pipe leaves the tube mills, en route to destination, or at a plant in your operating area. Strategic location is more than just convenience—it means substantial savings in storage and handling, lower through-freight costs, and less delivery time to jobsite.

What's more, these plant locations mean that, wherever you buy your pipe, you can get a uniform coating and wrapping job at a nearby PLS plant—no long shipping delays. If needed, you can have pipe wrapped at more than one PLS plant, delivered to the same jobsite, and be sure there is no difference in quality. Call in your nearest Pipe Line Service representative on your next coating job—he'll show you how PLS can give you the finest in pipe protection and still save you time and money.



Pipe Line Service Corporation

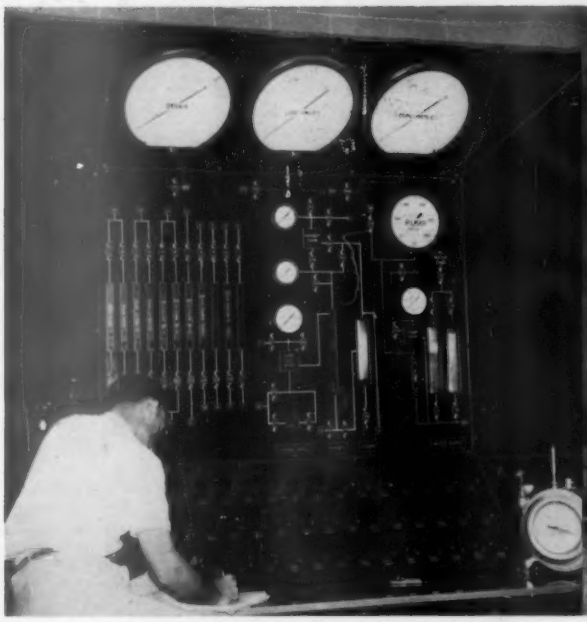
FRANKLIN PARK, ILLINOIS

Quality pioneers in coating and wrapping pipe for a quarter century

A SUBSIDIARY OF AMERICAN STEEL FOUNDRIES

There's a PLS plant strategically located to serve YOU!

THE ATLANTIC REFINING COMPANY
ANNOUNCES THE APPOINTMENT OF
JAMES A. LEWIS ENGINEERING, INC.
PETROLEUM RESERVOIR ANALYSTS
AS LICENSING AGENT FOR THE PATENTED
HIGH-PRESSURE GAS PROCESS
(A MISCIBLE DISPLACEMENT PROCESS)



CONTROL PANEL of the Atlantic Miscible Displacement high-pressure pilot plant at the Dallas Research and Development Laboratory. Panel has measuring and recording controls.

HIGH PRESSURE creates the miscible effect at Atlantic's project in the Block 31 Devonian field of Crane County, West Texas. The plant has compressors of 9500 HP and injects about 45,000,000 cu. ft. of gas daily.

With the appointment of James A. Lewis Engineering, Inc., as licensing agent, Atlantic offers to the industry a thoroughly tested and proved process for recovering the most crude possible from deep oil reservoirs. The large amount of laboratory and field data on the process — representing more than a decade of experience — now is available through the Lewis firm.

Basically, this high-pressure technique, pioneered by Atlantic, consists of sweeping the reservoir with gas that is miscible with crude oil. Greatly increased reserves effected by this process are recovered at high rates of production. Atlantic has succeeded in maintaining the daily output of one project for six and one-half years at 15,000 bbl., which is equivalent to 280 bbl. per day per producing well.

For full information on how Atlantic's patented miscible displacement process can be applied to your own operations, call RIverside 1-1877, Dallas, Texas; or write:
James A. Lewis Engineering, Inc.
2110 Republic National Bank Building
Dallas 1, Texas

THE ATLANTIC REFINING COMPANY **ATLANTIC**

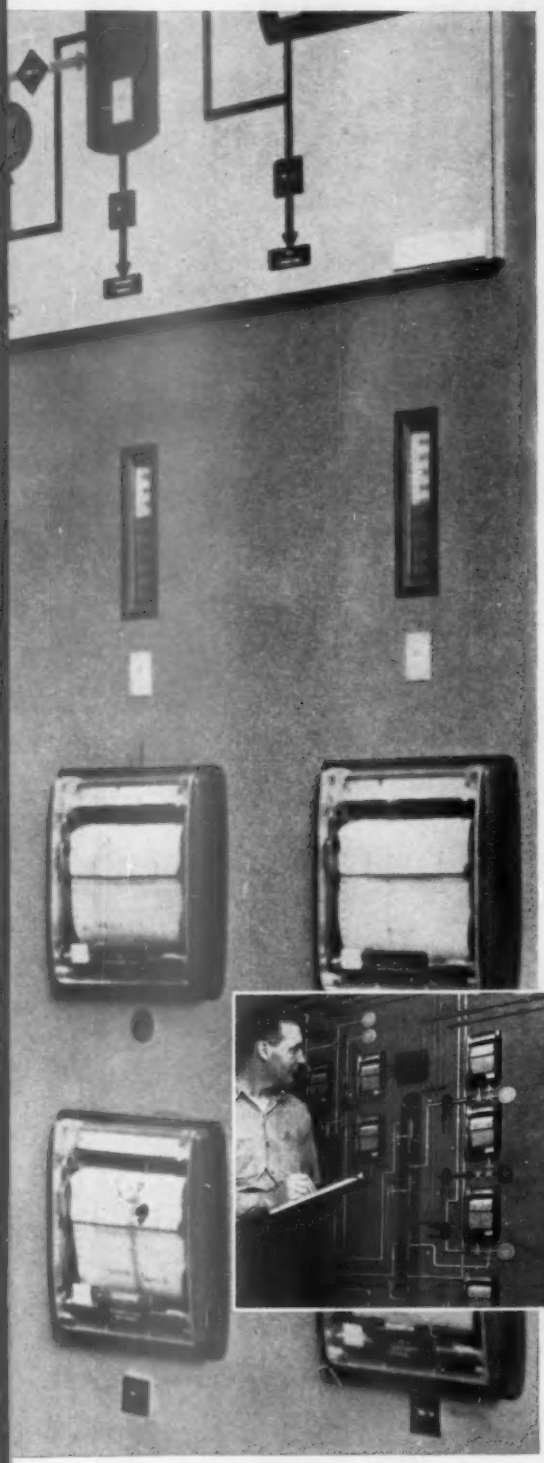
Esso looks to

Consotrol Control panel for Powerformer* at Esso's Bayway Refinery, Linden, New Jersey. Complete Consotrol Control Station slides out from front of panel as a unit — makes servicing easier for Esso technicians.

*Trade mark, Esso Standard Oil Company

Consotrol* instruments

for dependable control at their Bayway Refinery



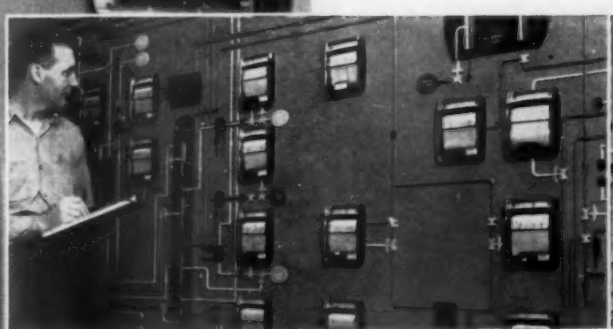
Precise, dependable, centralized control . . . full-scale, easy-to-read chart records . . . simplified maintenance from the front of the panel. No wonder leading refineries like Esso specify Foxboro pneumatic Consotrol instrumentation.

Consotrol control stations are so compact, four can fit where one circular chart instrument used to go. Yet recorders still have a full-scale, 4-inch chart — can furnish continuous recording of up to 3 different variables on the same chart.

Consotrol M/58 Controllers handle a full-range of control functions: auto-selector . . . cascade and ratio systems . . . automatic batch control.

Get the complete story on pneumatic Consotrol instrumentation by writing for Bulletin 13-18. **The Foxboro Company, 607 Neponset Ave., Foxboro, Mass.**

*Reg. U.S. Pat. Off.



▲ Foxboro control panel for #6 Pipe Still was installed in 1952. Consotrol recorders have a full-scale 4" chart which travels vertically. Pen arm moves in an arc — eliminates extra linkage common to instruments that must convert rotary motion to straight-line pen travel.

▲ This hydrofiner full-graphic panel was designed and built by Foxboro in 1954. Panel includes 54 Consotrol Recorders, 44 Controllers. Ethylene Plant control panel (not shown) includes another 100 Foxboro pneumatic Consotrol instruments.

FOXBORO

REG. U.S. PAT. OFF

New International 560 handles backhoe buckets up to 8.9 cu ft, up to 2 feet wide . . . does own backfilling with front-end loader. Save expense of short-haul truck and trailer transport by self-powered job-to-job moves!

Backhoe-loader combination: International Pippin

⅓ cu yd bite . . . on rubber!

New International® 560 tractor

Put more than 3 tons of built-in brawn plus tremendous hydraulic down-pressure behind a ⅓-yard bucket . . . the 72.5 hp* International 560 delivers *irresistible* force for digging more than 13 feet deep on the toughest trenching assignments!

You match . . . even outdig . . . single-purpose machines because of job-to-job mobility to handle small-yardage jobs that higher-priced, specialized rigs can't afford to touch. You get double-duty from the husky gasoline, diesel or LP Gas power plant, too, with the big capacity front end loader.

Ask your IH dealer to demonstrate the big, burly 560 . . . or others in the complete International wheel tractor line, 13.4 to 90 hp*. For free catalog, or name of your IH Dealer, write International Harvester Co., Dept. OGJ-7, P. O. Box 7333, Chicago 80, Ill.

**Maximum flywheel hp*

See your **INTERNATIONAL HARVESTER dealer**

International Harvester Products *pay for themselves in use* —Farm Tractors and Equipment . . . Twine . . . Commercial Wheel Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois

S&J-

PROVEN SOURCE FOR REMOTE DATA AND CONTROL SYSTEMS

From first in mechanical gages and tank fittings—to leadership in Data Telemetering and Remote Supervisory Control.

That's the Shand and Jurs story. Out of our Electrical Products Division comes S&J High Speed Telepulse for telemetering level, temperature, pressure and function control. Proven S&J Gardtrol is serving in remote supervisory control applications throughout the country. And S&J Datalogger presents the latest achievements in tank gaging automation. Remember S&J—the name to know in telemetry and supervisory control.

SHAND AND JURS A GENERAL PRECISION COMPANY

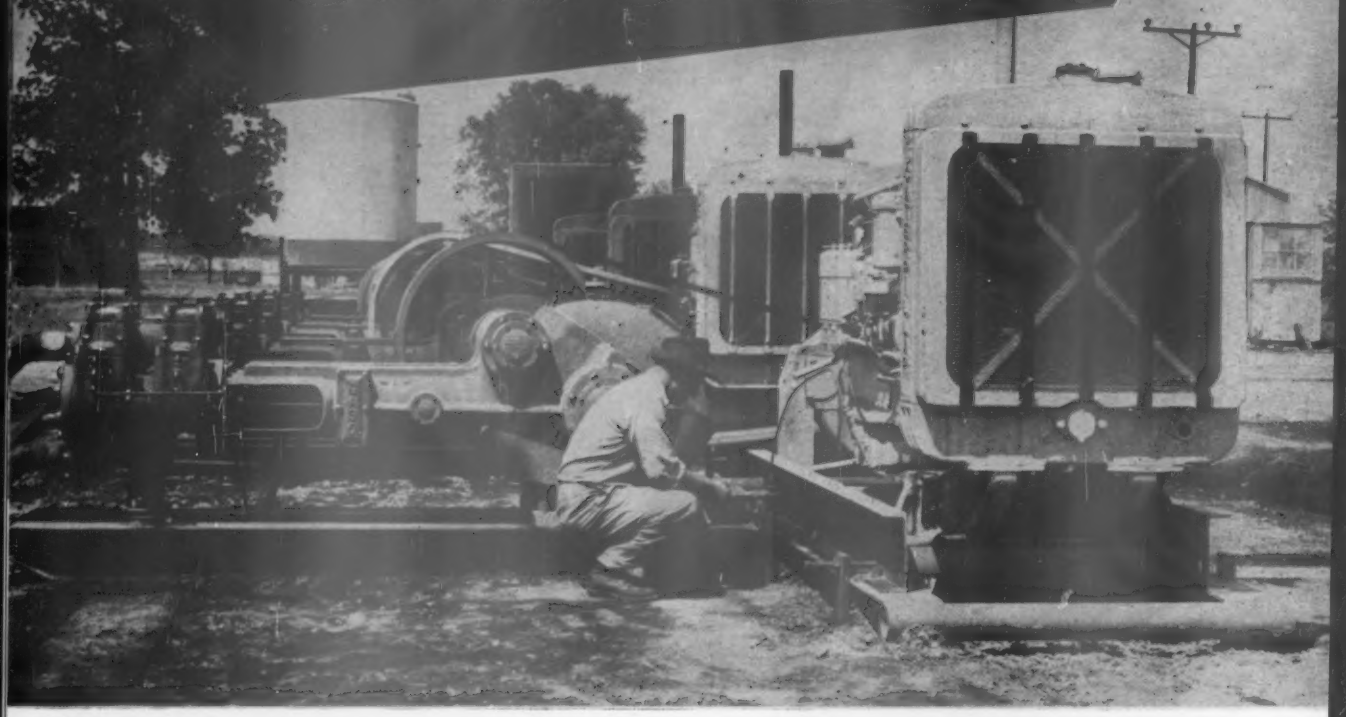
SHAND AND JURS COMPANY

2600 Eighth Street, Berkeley, California

A subsidiary of General Precision Equipment Corporation

6533

NOTICE OF 44th ANNUAL EXTRA DIVIDEND



In 1959, as in 43 previous years, users of Gaso Pumps will receive extra dividends on their investment . . .

—an EXTRA degree of operating efficiency, resulting from the fact that Gasos are available in models precisely suited to individual needs.

—an EXTRA measure of economy, stemming from Gaso's traditionally low maintenance cost.

—EXTRA years of life, proved by the fact that thousands of Gaso Pumps long past normal "retirement" age are still delivering a full quota of service.

Extra dividends on their investment are another reason why so many companies specify Gaso Pumps as "standard equipment" in their capacity range.

Write for our latest catalog.

DISTRIBUTORS:

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Shreveport, La.—W. L. Somner Co.
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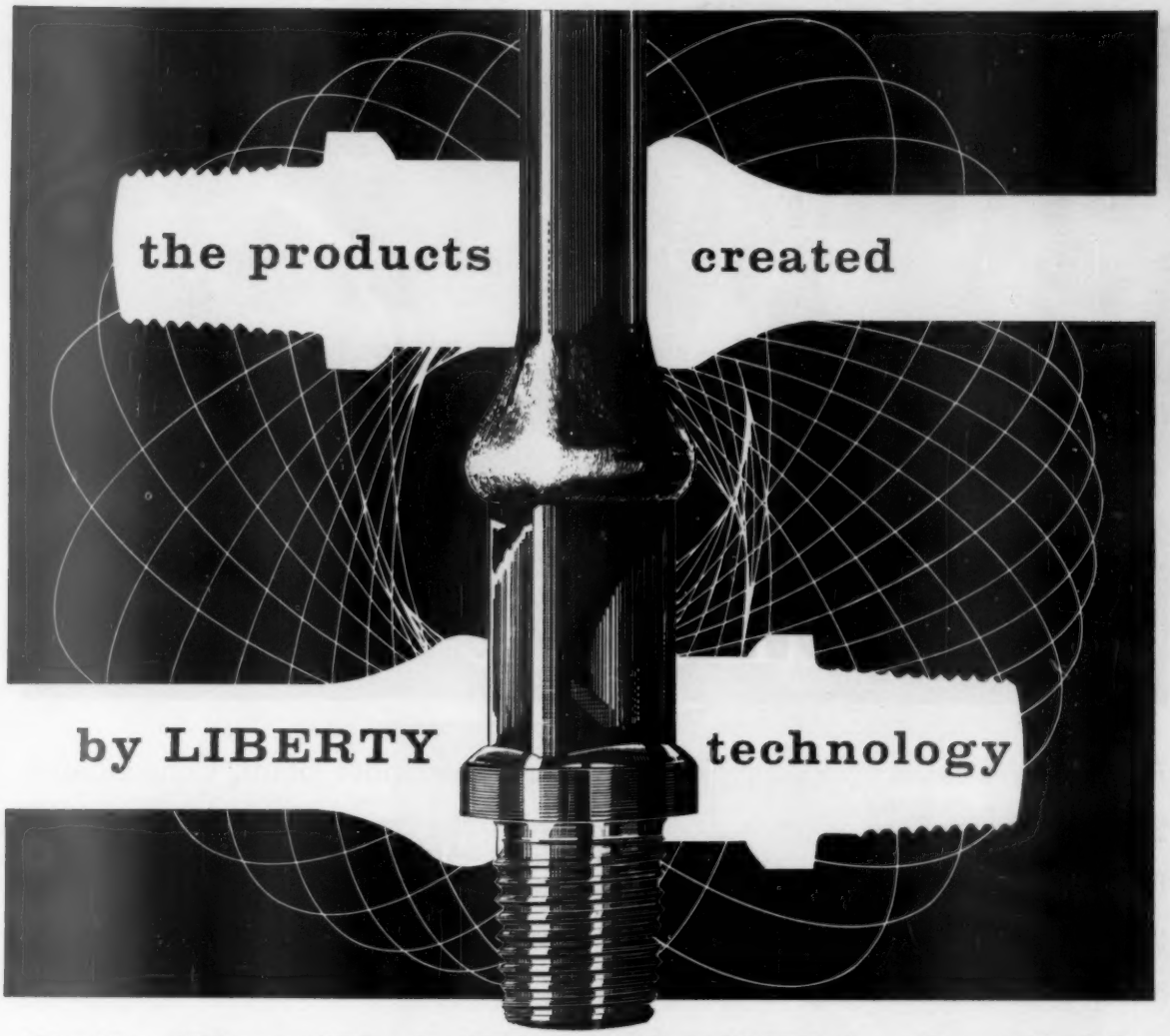
GASO PUMPS
for every oil industry need

100th Anniversary of Oil in America 1959 **44th Anniversary of Gaso Leadership**



Daily Show Their EXCELLENCE in the Field

Save 10% to 33⅓% on pumping from low fluid-volume wells to 5,000 feet, with the LIBERTY ½-INCH SUCKER ROD–the newest product of LIBERTY technology.

To get complete information on the LIBERTY ½-INCH SUCKER ROD, send today for technical information.

All LIBERTY products are sold only in Supply Stores, through the LIBERTY SERVICE NETWORK.

There are many reasons for the excellence of LIBERTY SUCKER RODS and PUMPING UNITS but there is only one final proof: the performance which LIBERTY products give in day after day of hard field use.

In this way, LIBERTY SUCKER RODS and PUMPING UNITS have been serving the oil production industry for over 40 years, in every kind of pumping condition.

LIBERTY Field Representatives bring the same quality of excellence, in their training and experience, to assist you in designing installations for maximum efficiency in your pumping operations.

To learn more about LIBERTY products and services, write or call–

LIBERTY

MANUFACTURING COMPANY OF TEXAS

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LM-5

now full-scale control

First with a fully operating computer-controlled pilot plant, Consolidated Systems now offers automatic control from the first order closed loop to full-scale automation in refineries, chemical plants, and pipe lines. Adaptation of "Microplant" unattended pilot plant equipment and philosophies to other problems... tieing together analytical equipment, control equipment, and computer systems . . . can be accomplished now through the unique experience and capabilities of Consolidated. For full information, write for Bulletin CEC 3019-X5.

CONSOLIDATED SYSTEMS CORPORATION

1500 S. Shamrock, Monrovia, California

A SUBSIDIARY OF CONSOLIDATED ELECTRODYNAMICS

The Microplant, an automatic, unattended pilot plant for process data, includes utilities, reactor, and distillation. Instrumentation includes digital computer, digital programmer, logger, scanner, product-composition analyzers, controllers, and graphic panel.

DAVISON

When gases must be DRY

Davison Hi-Sorb Silica Gel dries better

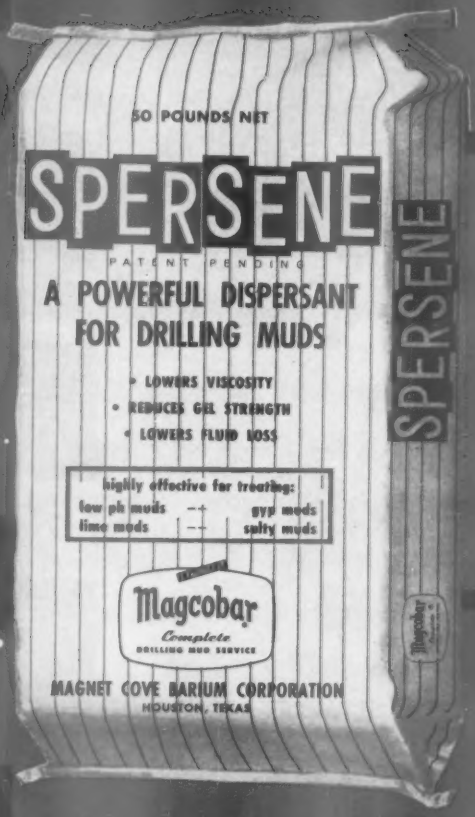
That's why Davison Silica Gel is so often to be found in natural gas dehydrators . . . in gas streams . . . in the refinery. Davison Silica Gel prevents hydrate formation which clogs lines, causes high-pressure losses and high maintenance costs. It decreases corrosion in equipment and reduces power costs in compression. Not least—it keeps customers happy! There's nothing better obtainable. Write Dept. 3117 today for full information.

W.R. GRACE & CO.
DAVISON CHEMICAL DIVISION
BALTIMORE 3, MARYLAND

Now

SPERSENE

Magcobar's *new* all-purpose dispersant cuts costs *in any kind of mud*



another *well done*

Spersene, a very versatile thinner, performs well in any mud. Its powerful thinning action combined with low cost make it a unique chemical for treating any drilling mud. You need no longer stockpile a number of dispersants at your well to meet different mud conditions. Now, you can simplify mud treatments with this new all-purpose dispersant and cut mud chemical costs, too.

Spersene costs less when you buy it; costs much less when you use it. As the tables show, Spersene lowers viscosity more effectively, at less cost, than any of today's leading thinners. This means a lower cost per barrel with Spersene. When projected to well volume, it means surprising savings. Whether you are using high or low pH mud, gyp mud, lime mud, or seawater or brackish mud, laboratory tests prove that Spersene

	Amount (pounds)	MATERIALS	Average Cost (Cents)	VISCOSITY (Yield Point-lb./100 ft.^{2})
gyp muds	1	Spersene	16.5	7
	1	Thinner A	18.5	14
lime muds	3.0	Spersene	49.5	6
	3.0	Thinner A	65.5	16
low pH muds	1	Spersene	16.5	8
	1	Thinner A	18.5	12
	2	Thinner B	20.0	20
	1	Thinner C	18.0	18
	1	Thinner D	17.0	31
sea water muds	4	Spersene	66	1
	4	Thinner A	74	3

is more efficient on basis of costs than any other dispersant. And it is very stable against the upsetting effect of salt.

Spersene is one more specific Magcobar solution to the problem of high drilling costs, one more development from the Magcobar laboratories that will increase your profit through more economical drilling. From spudding in to total depth, you'll find that the right products *used right* by Magcobar engineers can cut your drilling costs, too. Write for the new bulletin on Spersene.

Wherever your drilling operations, you can use Magcobar engineering and products. There are more than 500 stockpoints in the U.S. and Canada. Elsewhere, write Foreign Operations, P. O. Box 6504, Houston, Texas

with Magcobar Technology

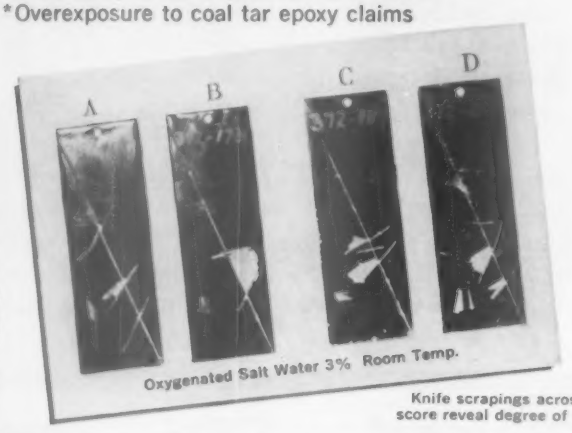
Magcobar® *Complete* DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION

Houston

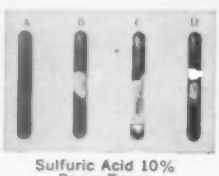
SUFFERING FROM COALTAREPOXICATION?*

*Overexposure to coal tar epoxy claims

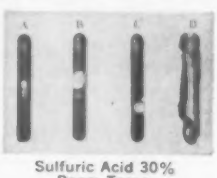


Knife scrapings across diagonal score reveal degree of undercutting.

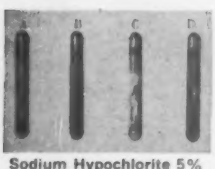
Caustic Soda 5% Room Temp.



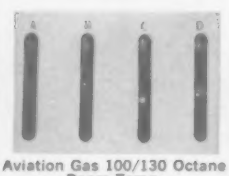
Sulfuric Acid 10% Room Temp.



Sulfuric Acid 30% Room Temp.

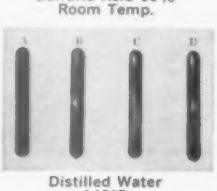


Sodium Hypochlorite 5% Room Temp.

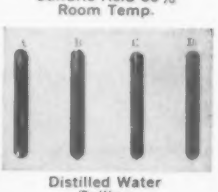


Aviation Gas 100/130 Octane Room Temp.

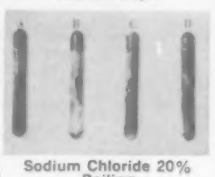
Salt Spray (scored panels) Room Temp.



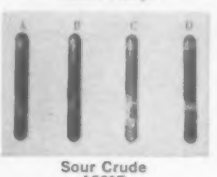
Distilled Water 140°F



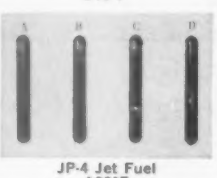
Distilled Water Boiling



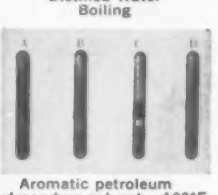
Sodium Chloride 20% Boiling



Sour Crude 120°F



JP-4 Jet Fuel 120°F



Aromatic petroleum hydrocarbon solvent—120°F

Try these tests to end the confusion

116

So many conflicting claims have been made about virtually every coal tar epoxy coating on the market that prospective users are finding it difficult to fish out the facts from a sea of superlatives.

Perhaps you can find *your* answer by duplicating any or all of these laboratory tests comparing the four leading coal tar epoxies.

THE TESTS: The rods and panels illustrated here were carefully coated to the four manufacturers' specifications and then subjected for three months to the corrosive agents indicated above. The wide range of tests included varying concentrations of chemicals, ambient and elevated temperatures, weathering and all usual types of exposure.

THE RESULTS: Some results were predictable, such as the failure of all four coatings to withstand aromatic petroleum hydrocarbon solvent. But striking differences occurred in such tests as oxygenated salt water, when only Coating A (Amercoat No. 78) resisted undercutting. Products B, C and D were all blistered and undercut to varying degrees. In none of the remaining tests was Amercoat No. 78 excelled, and in most cases it showed marked superiority.

CONFIRMATION: The properties attributed to No. 78 in these tests have been substantiated repeatedly in actual field use. Applicators like it because it (1) gives dependable, all-around protection, (2) sprays more easily than competitive products, (3) builds thick films without difficulty because of its higher solids content, and (4) dries thoroughly but at a moderate rate, avoiding the extremes of prolonged tackiness and fast-dried brittleness.

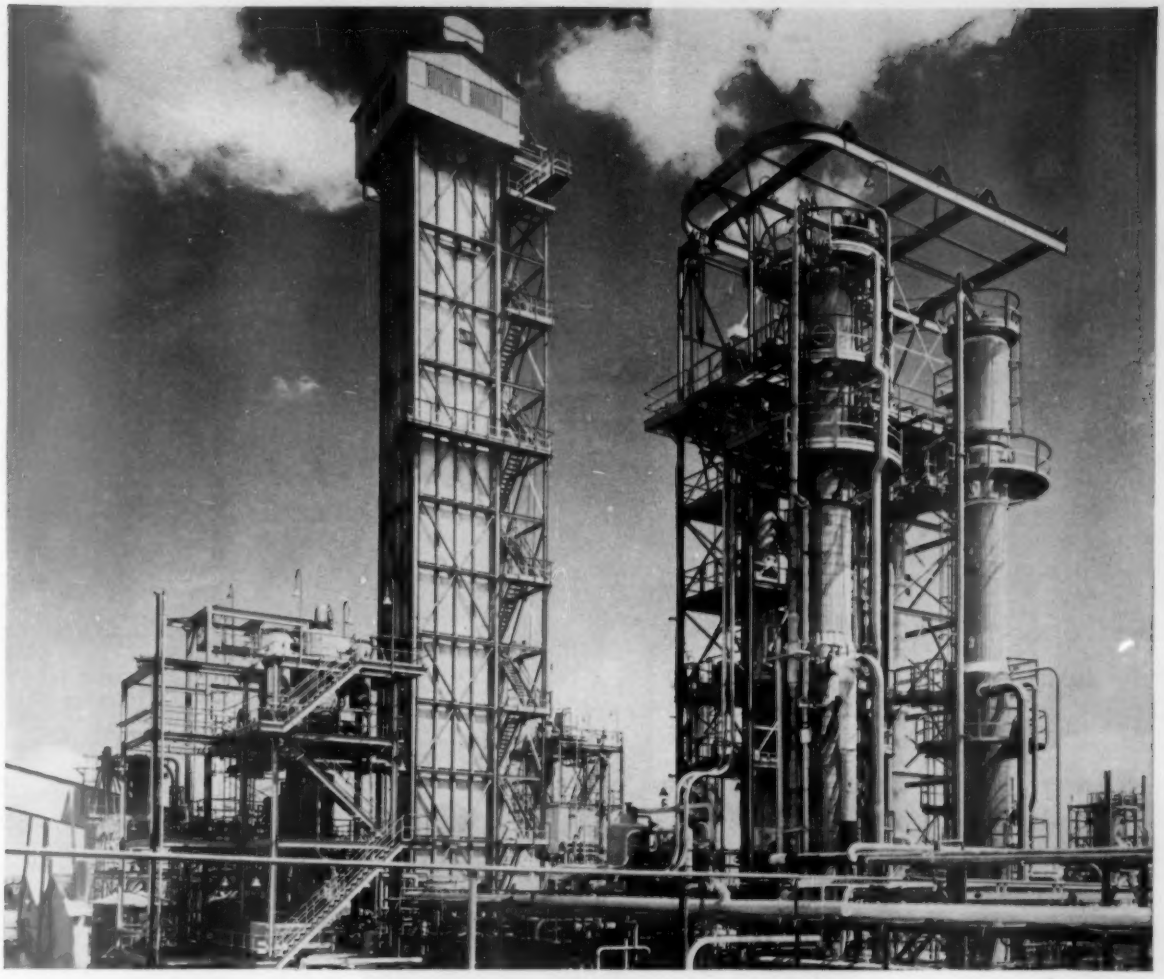
Because of the unusual importance of these tests to prospective users of coal tar epoxy coatings, we have prepared illustrated copies of the complete report. Write for yours today!

(Amercoat No. 78 was formerly designated No. 1686)

Amercoat® CORPORATION

Dept. CG
4809 Firestone Boulevard
South Gate, California

921 Pitner Ave. Evanston, Ill. 360 Carnegie Ave. Kenilworth, N.J 2404 Dennis St. Jacksonville, Fla. 6530 Supply Row Houston, Texas



A precedent-setting new concept in engineering service

The Pechiney-Grace Urea Process by Foster Wheeler

Now Pechiney's basic urea synthesis, Grace's operating experience and Foster Wheeler's engineering design and construction experience are available as a totally new packaged service to licensees.

It's a unique package, giving you:

- a total recycle process covered by one licensing agreement, from feed end through finishing operations, yielding urea of the highest purity.
- the benefits of experience gained by W. R. Grace in modifying and improving the original Pechiney Process and operating a full-scale plant for four years.
- Foster Wheeler's experience in originally bringing the Pechiney Process from pilot plant to full-scale commercial operation, and working with Grace engineers on subsequent improvements which created the Pechiney-Grace Process.

The new license package also makes available for the first time a new ammonia recovery system—currently saving 10-15 tons a day for Grace, and a highly efficient purification system. For information write to: *Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, N. Y.*

FOSTER WHEELER

NEW YORK LONDON PARIS ST. CATHARINES, ONT.

LIGHTWALL . . . biggest value for your pipeline dollar

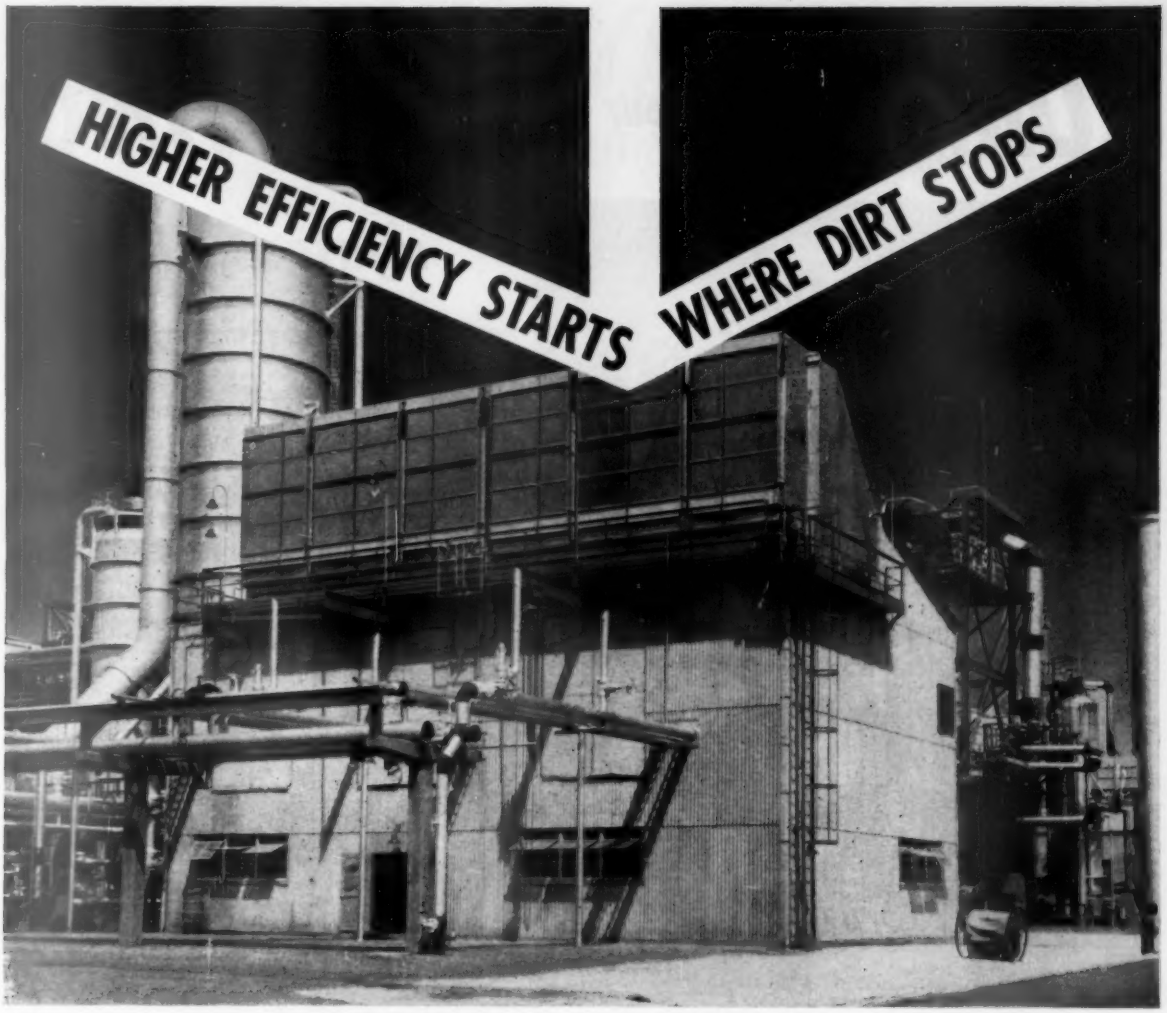
Southwestern LIGHTWALL Electric Resistance-Weld Line Pipe greatly reduces weight without sacrificing performance . . . delivers actual dollar savings four ways over standard-weight pipe. With Southwestern LIGHTWALL, every customer benefits from savings in initial cost, transportation, installation, and in longer life when given proper corrosion protection. Southwestern LIGHTWALL Electric Resistance-Weld Line Pipe is available in a wide range of wall thicknesses to .188" wall, from 1.315" O.D. to 4.500" O.D. Because of Southwestern's manufacturing flexibility and large inventories of selected steel coils, you can depend on prompt deliveries.

LICENSED BY THE AMERICAN PETROLEUM INSTITUTE

SOUTHWESTERN PIPE, INC.*

** Corporate name changed from Southern Sales & Transportation Co., May 1st, 1959*

P. O. BOX 2002 HOUSTON 1, TEXAS PHONE CAPITOL 4-0631



AAF cleans and cools intake air, helps boost petrochemical output

At Odessa Budadiene Co., Odessa, Texas, they're using the hot exhaust from two gas turbines to regenerate catalysts in the manufacture of budadiene.

A combination of MULTI-DUTY automatic, self-cleaning filters and Amer-Kool evaporative coolers assures clean, cool intake air for both 8500-HP turbines. The automatic intake filters operate continuously, while the evaporative coolers are operated only when ambient temperatures necessitate cooling the air for increased turbine output.

Whether your operation is in a hot and dusty desert, a temperate region, or the Arctic — whether the application is one of process or pumping — whether your station is automatic or attended, portable or stationary — AAF has air filtration equipment *engineered* to match your requirements!

For information on AAF's complete line of BETTER AIR products for engines and compressors, write today for Bulletin 150. Address: Mr. Robert Moore, American Air Filter Co., Inc., 444 Central Avenue, Louisville, Kentucky.

AAF American Air Filter
BETTER AIR IS OUR BUSINESS

COMPARE your cost of DITCHING

against this

MASSEY-FERGUSON powered

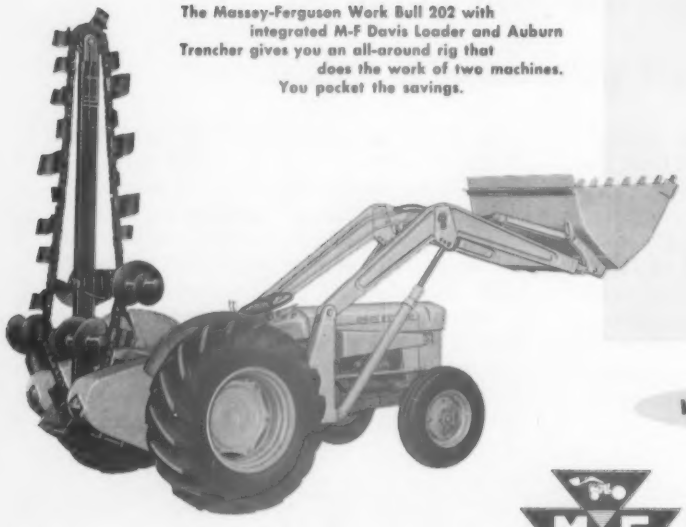
AUBURN GEAR-DRAULIC®

TRENCHER

Trenches in more adverse soil conditions than any other trencher.

Provides the lowest cost per foot of trench without sacrificing quality of work.

The Massey-Ferguson Work Bull 202 with integrated M-F Davis Loader and Auburn Trencher gives you an all-around rig that does the work of two machines. You pocket the savings.



This power-matched Massey-Ferguson Work Bull 202 and Auburn Trencher gives you more ditch for your money than any other trencher. Speeds up to 800 ft. per hour, depths to 6 feet, and widths from 6-to-14 inches. It's virtually trouble-free, works in soil where others won't, automatically adjusts forward speeds to changing soil conditions. Spreads spoil to both sides for easier backfilling, less disturbance to landscape. One-man operation.

Why Wait? Set a Date — We'll Demonstrate!

MASSEY-FERGUSON
INDUSTRIAL DIVISION
Block 1000 South West Street • Wichita 13N, Kansas

Anti-lock prevents relative rotation between anchor cage and tubing while running

Re-latch threads prevent upper slips from setting until ready.

Long, flexible drag springs allow easy recovery in case of washover.

Special seal protects against fouling from sand or scale.

Internal shoulder creates a differential piston inside rubber to cause a tighter seal.

Full setting force is transmitted to packing element through lower head. No scrubbing action between lower slips and casing wall during setting stroke.

Guiberson permanent completion

TYPE A DRILLABLE PACKER

runs and sets easily, quickly

- ***Built-in safety against premature setting***
- ***Set and produce in ½ tubing trip***
- ***Unequalled rubber seal***

Guiberson Type A Drillable Packer gives you a versatile packer for many uses..single or multiple zone production, acidizing, pressuring operations, water-flooding, testing, corrosion control and many others.

New safety factors against premature setting are provided since the transmitting of drag from tight casing or impact from junk is direct to the tubing string.

The Type A can be set and placed in production with only ½ tubing trip. Spacing problems are easier, especially when run in combination with a multiple zone packer. From rig floor to completion, the Type A runs and sets faster than any other permanent packer.

Guiberson superior quality rubber and special lead-alloy thimbles compress fully for a leak-proof seal. Setting is quick, easy and uncomplicated..may be set by wire line. Available in 5" through 7⅝" sizes for 2" or 2½" tubing with a full line of stingers and accessories. Ask your Guiberson representative for a recommended installation or write for full details.

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CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
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Oil Field Supply Stores
Everywhere

A look at today . . . and a glimpse

Armour Chemicals for refinery applications

Where they work today

Every major phase of the refining operation can profitably use one or more of Armour's economical, cationic chemicals. Here are three typical applications for these chemicals: *hydrochloric acid inhibition, fuel oil additives* and *cationic asphalt emulsions.* We suggest you look into Armour's aliphatic organic compounds and see how they can work for you.

HCl Corrosion Inhibition

Armour Chemical announces a new corrosion inhibitor for hydrochloric acid—Armohib® 28.

This fatty-nitrogen-derived chemical is of particular interest to refiners for use during refinery clean-ups. It inhibits the HCl from attacking and pitting metal surfaces, yet it *does not* interfere with the cleaning action of HCl in removing scale or fouling deposits in processing equipment and boiler feed waters.

Armohib 28 has been proved effective in 5%, 10%, and 15% HCl solutions at temperatures ranging from ambient to over 200°F. It is non-staining, will not deposit a waxy surface on treated metal, and leaves surfaces bright and clean.

Tentative specifications

Activity	100%
Equivalents per gram (as titratable amine)	.00155
Flash Point	90° F
Pour Point	60°F
Solubility	
in HCl	Soluble
in water	Dispersible
in mineral oil	Soluble to 50%
in fuel oil	Soluble to 50%
Specific gravity	0.939
Physical appearance @ 25°C	Dark brown liquid

Armohib 28 effectively controls corrosion on 316 stainless steel, monel, bronze, and mild steel. It will not precipitate in the presence of ferric ions.

As little as 0.08% of the inhibitor in 10% HCl at 120°F has been proved effective, with the treated metal (mild steel) showing a weight loss of only 0.00470 lbs/ft²/day.

If HCl corrosion, pitting and/or foaming is your problem, investigate Armohib 28.

For more information, and test results, check "A" in coupon.

Fuel oil additives

One of the country's largest refiners recently evaluated a variety of organic compounds as fuel oil dispersant additives. Armour's cationic chemicals were found to be the most economical and effective sludge dispersants of all the additives tested.

The test consisted of circulating fuel oil containing a weighed amount of sludge through a fuel burner pump with a 100-mesh monel strainer. Comparative results were as follows:

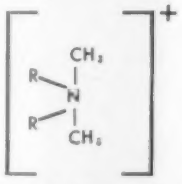
Typical Comparison Tests

	Chemical X (dispersant type additive)	Arquad 2HT	Arquad 2S plus Armolad F2S
Cost/bbl.	1.0¢	0.6¢	0.8¢
Concentration	100 ppm	50 ppm	25-50 ppm
% Dispersibility	78%	94%	96%

Of all the different compounds tested, Armour's Arquads® (quaternary ammonium chlorides) were the most effective dispersants. Screen deposits in the test fuel oil/water system were reduced by 94%.

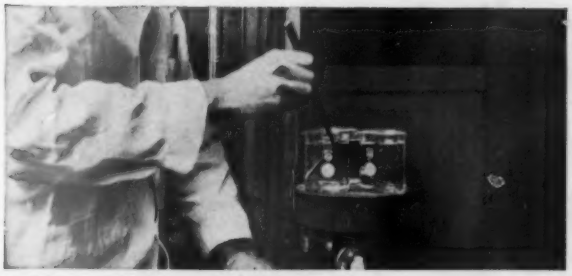
When the Arquads were combined with the Armolads®—Armour's series of inhibitor-dispersant type fuel oil additives—there was a noticeable increase of dispersing properties. Even with low concentrations of Arquads, the mixture was highly effective.

It is hypothesized that the cationic portion of the chemical mixture, i.e.,



combines with the insoluble gum or sludge to form a finely dispersed complex which allows the fuel to be cleanly burned.

These tests are of special significance to companies that store fuel oil for long durations in warm weather. In addition, these findings will help companies that mix different fuel oils in storage tanks, or that face



# of tomorrow

from Armour Chemical

the possibility of home consumers mixing different blends of #2 fuels.

Check "B" in coupon for detailed information on this test.

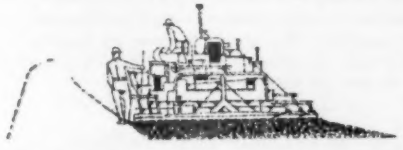
Cationic asphalt emulsions

Armour's high molecular weight amines have been proved highly effective for cationic asphalt emulsions.

These chemicals are ionized in solution and produce positively-charged asphalt particles. Since most surfaces are negatively-charged, the asphalt, when emulsified with Armour cationic amines, will deposit completely and irreversibly on almost any metal or mineral surface.

Research by Armour, several leading universities, and asphalt producers shows these new cationic asphalt emulsions to have several distinct advantages:

- They can be used in economical concentrations at a cost as low as 1.5¢ per gallon of asphalt emulsion.
- Asphalt from any crude source can be emulsified successfully.
- Asphalt sticks even to water-soaked aggregate for road building. Any water on the surface is displaced. This "plating out" action means road building can go on even during damp or wet weather.



- Cationic asphalt emulsions are not sensitive to "hard" water during processing and use.
- They are effective on a broad range of aggregates, even many so-called inferior or hard-to-coat types.

Armour asphalt specialists are continuing research and application testings. Uses of cationic asphalt emulsions, for binding and waterproofing, now under study include highway construction and maintenance, linings for irrigation ditches and ponds, pipe and tank coatings, undercoatings, paper laminates and impregnants, as well as adhesives and mastics.

Patents for these cationic emulsions have been applied for.

For more data, check "C" in the coupon.

Where Armour Chemicals for refineries will work tomorrow

Alpha sulfonated fatty acids or their amine salts present interesting surface-active materials for hydrocarbon systems. Lubricity and extreme pressure stability additives are two of the possible areas of application now being field-tested.

Armour's chemicals are helping solve problems in every major area in refineries. Do you know enough about them? Talk to our chemical specialists for suggestions as to the right additive or basic chemical for your products or situation. Write or call Armour today.

NEWS NOTES

Chicago. Armour and Company announces its Chemical and Ammonia Divisions have been combined to form the Armour Industrial Chemical Company. The new organization will have its general offices at 110 North Wacker Drive, Chicago 6, Illinois.

•

Oakville/Toronto, Ontario. The Armour Industrial Chemical Company has established a Canadian sales office here to service Canadian industries with technical assistance in the use of cationic chemicals. Supplies of Armour Chemicals are now available from Canadian production facilities and local inventories.

•

Washington, D.C. Two U. S. patents, #2,851,344 and 2,851,345, were recently issued to Armour Chemical for the manufacture of amphoterics (Zwitterions) for use as additives in fuel oil.

Leader in Progressive Fatty Acid Chemistry

Armour Industrial Chemical Company

a Division of Armour and Company

Put Armour Chemicals to work for you

Check here for more information on your field of interest.

☐ A ☐ B ☐ C

Send sample and more information for this application:

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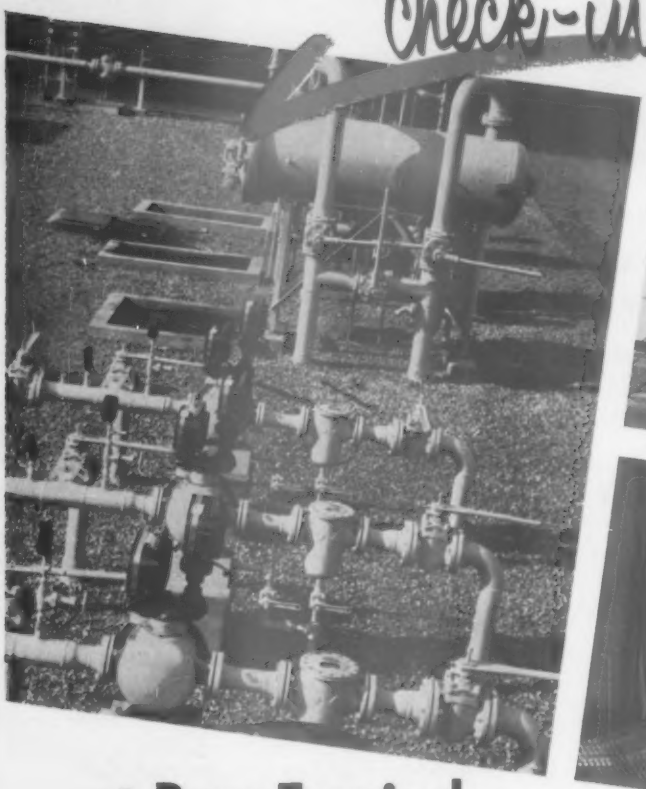
Armour Industrial Chemical Company
110 North Wacker Drive • Chicago 6, Ill.

OGJ-7-59

S.P. Pipeline Products

check-in .... check-out



...at Reno Terminal through BRODIE *BiRotor* Meters

At the new Reno, Nevada terminal of Southern Pacific Pipe Lines, Inc., incoming products are measured through these Brodie *BiRotor* Meters, protected by Brodie Strainers. Prior to a change of product, operator shifts the *Brodimatic* Dual Printing Counters without stopping flow. This makes it easy to keep accurate printed records of each product tender received through the line from Richmond, California — over 250 miles southwest and 4,400 feet lower elevation.

Products are delivered through 16 Brodie *BiRotor* Meters on the S. P. Reno loading rack. Double case construction isolates measuring elements from piping strain, permits meter mounting in the loading arm. Advantages are: economy of installation, simplified piping, counter always facing point of delivery for easy reading, clear working areas on loading deck and under the rack. *Brodimatic* printing counters assure accurate records, easier accounting. 903

EVERYWHERE – *Brodie is linked with Progress. Here's another example from Nevada.*

This new pipeline is set up to handle products from refineries and other shippers—with delivery takeoffs in California's Sacramento Valley, Reno and Fallon, Nevada.

On this type of operation, the *sustained accuracy* of *BiRotor* meters is essential to shippers, pipeline and customers. Whatever your metering problems—get in touch with your Brodie Metering Specialist—as near as your phone.

BRODIE
BiRotor METERS

RALPH N. BRODIE COMPANY • San Leandro, California, U. S. A.
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JOHN DEERE DIESEL BACKHOE-LOADER

helps wring more work from every equipment dollar

From bucket to bucket, here's a machine built to give you top earth-moving efficiency per dollar—the kind of performance required to keep trucks and other equipment busy and productive.

The John Deere "440" Diesel Crawler features a heavy-duty transmission with new working speeds and a clutch-type direction reverser to speed loading cycle time.

Loader bucket is self-leveling. For heavy digging, there's a 35-degree bucket roll-back, providing plenty of pry-out pressure. Capacity, heaped—⅞ yard.

Five-position John Deere 51 Backhoe digs flush left or right, repositions quickly in the field—by hydraulic power. Boom and dipper stick fold snugly against tractor for transporting, with rotary cylinder at left or right.

Why not accept your dealer's invitation for a demonstration?

Immediate Ownership Through the John Deere Credit Plan

Just a reasonable amount down, and you can paint your name on the side of any John Deere Industrial Unit—put it to work earning the monthly or seasonal payments agreed on. All arrangements are made with the dealer in strict confidence.

John Deere Industrial Division, Dept. 561, Moline, Illinois.

JOHN DEERE *"Specialists in Low-Cost Power with a Heavyweight Punch"*

YOU CAN'T BARGAIN WITH SAFETY

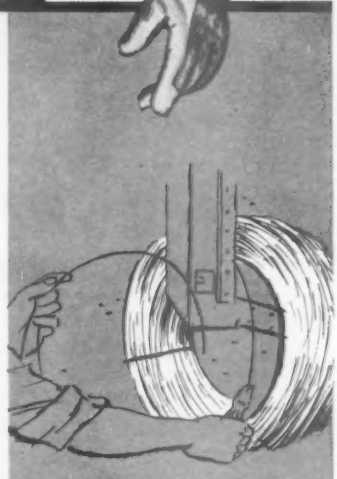
Wire Ropes may look alike... but it's performance that counts

The Image of CF&I stands for the top performance records of all CF&I steel products. For instance, take one of these products—CF&I-Wickwire Rope.

• Many brands of rope *look* alike but the rope you buy must pay off in *performance*, not *appearance*. With Wickwire Rope you get a number of quality factors that lead to outstanding performance. These factors are "built-in" the rope through many quality controls and tests. Since CF&I performs all steel producing, wire making and rope fabricating operations within its own plants, exacting control and testing procedures can be carried out and supervised at every step. Here is just one of these procedures:

Both-Ends Physical Tests
Samples are cut from both ends of every coil of wire and given complete physical tests — for tensile strength, roundness, torsion and uniformity of diameter. Coils that fail any test are rejected for such critical applications as wire rope.

We have recently printed several folders that discuss many more Wickwire control and testing procedures, plus wire rope recommendations for specific equipment. To get a copy, contact the nearest CF&I sales office—but please *state your industry or type of equipment.*



Both-ends testing of wire ensures safety and top performance in CF&I-Wickwire Rope.

WICKWIRE ROPE
THE COLORADO FUEL AND IRON CORPORATION
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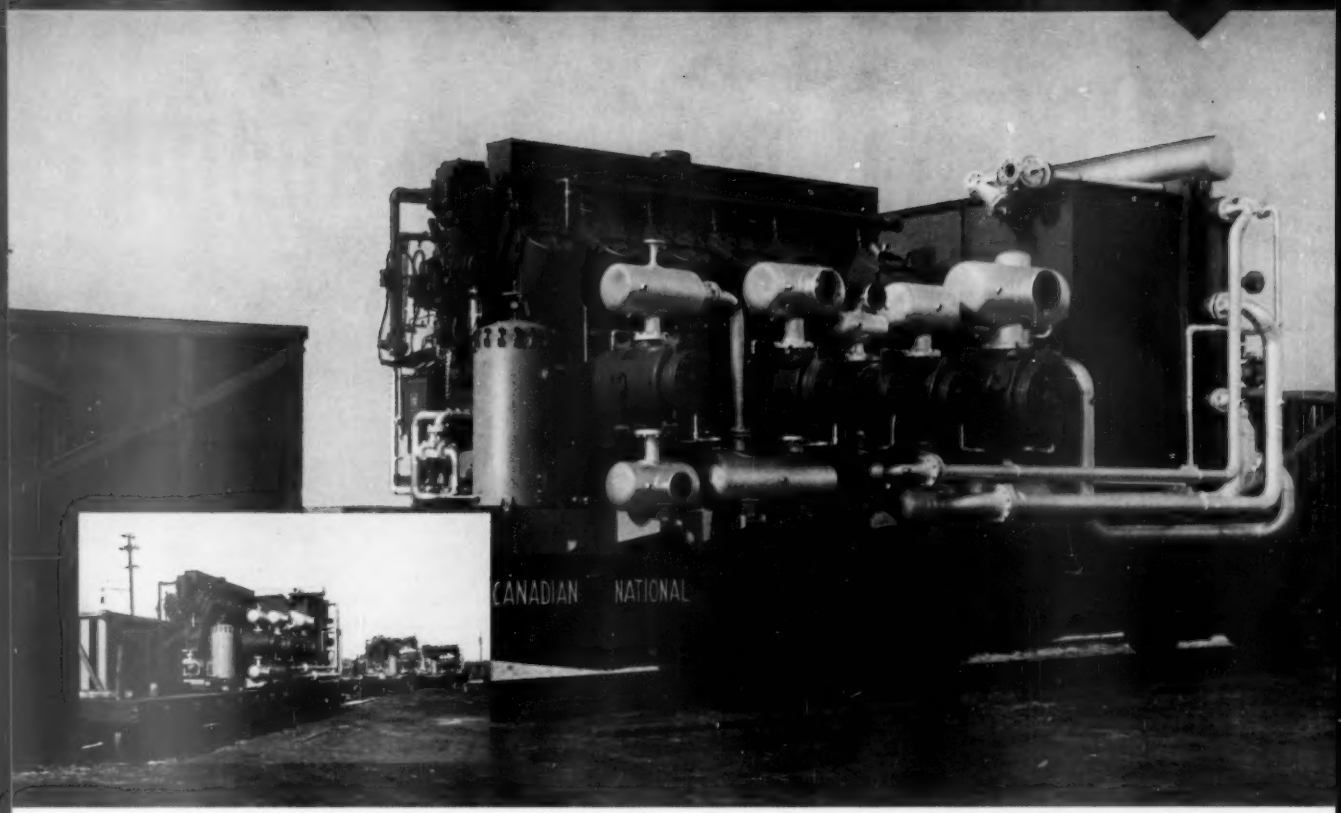
In the West: THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver • El Paso
Farmington (N. M.) • Fort Worth • Houston • Kansas City • Lincoln • Los Angeles • Oakland • Odessa (Tex.) • Oklahoma City • Phoenix
Portland • Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Tulsa • Wichita
In the East: WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) • New Orleans
New York • Philadelphia

CF&I STEEL

BEAIRD-INGERSOLL-RAND Packaged Compressor Plant

Lowest Cost Per Horsepower Installed



CANADIAN BUILT Beaird-Ingersoll-Rand, 660 h.p. 12SVG packaged compressor units have Young radiators with up-draft air discharge. Interstage gas, engine water and lubricating oil cooling sections are built into the radiator. Other sizes from 120 to 660 h.p.

Beaird Packaged Compressors—

MADE IN CANADA

BEAIRD
another AMF product
PACKAGED COMPRESSOR PLANTS

Packaged Compressors are just one of the many products manufactured by Beaird for the petroleum and petrochemical industries. When you are in the market for new equipment or assistance in developing a specialized product . . . contact Beaird for a qualified appraisal or quotation.

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These three 660 h.p. Beaird-Ingersoll-Rand packaged compressor plants are among the first 18 Canadian-built units to be delivered by Beaird International, Inc., Calgary. This new Beaird subsidiary offers Canadian producers complete sales, service and available manufacturing facilities.

Designed for a major oil company, the units will serve a dual role in gas processing and boosting. Three stages will be used for gas boosting and two stages will handle propane for the chilling process. Another example of the flexibility possible in solving gas production problems, these compressors reflect Beaird's years of design and field experience.

With Canadian facilities, Beaird International offers a single source of responsibility from initial quotation to field service. Beaird offices in Caracas, Venezuela serve South American markets.

Wherever oil or gas is produced, there are skilled Beaird gas engineers to assist in finding an economical solution to your special operating requirements.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana

A Subsidiary of American Machine & Foundry Company

SALES OFFICES: *Shreveport, New Orleans, Louisiana • New York, New York • Tulsa, Oklahoma • Houston, Corpus Christi and Midland, Texas and Cie. Ingersoll-Rand, Paris, France.*

BEAIRD INTERNATIONAL, INC. SHREVEPORT, LOUISIANA • *Sales Offices: Calgary, Alberta, Canada • Caracas, Venezuela.*

How much is EFFICIENT mud de-sanding worth to you?

Comparative tests have shown actual savings of nearly 6000 Dollars per well when Dorrco D-Sanders were used in drilling South Louisiana wells. With results like that, the cost of the D-Sander was paid off fast and overall well costs were substantially reduced.

Many users of other designs, some shop-fabricated and some purchased, have found that mere treatment of mud with a cyclone action is not sufficient to obtain the results reported above.

What was the difference?

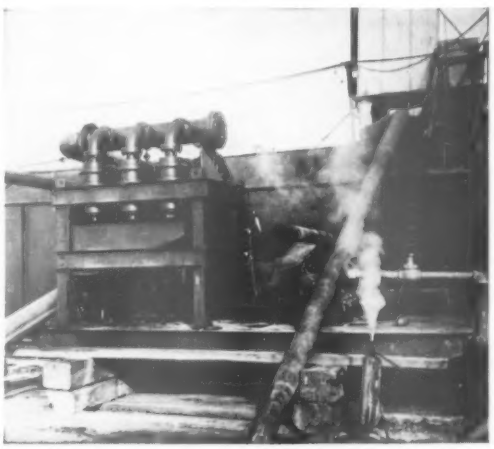
The main difference was the de-sander actually used. The comparative tests mentioned here were conducted using a high-capacity Dorrco D-Sander that had been engineered by Salt Water Control, Incorporated, of Fort Worth.

This unit removes virtually all the sand and much of the finer drilled solids from 600 to 800 gallons of mud per minute. By actual measurement, a Dorrco D-Sander has removed over 1500 barrels of sand and clay from the mud while drilling a single well to 9200 feet, thereby keeping sand content less than one-half per cent and solids low.

An important advantage of the Dorrco cyclone is its "balanced" design. Since there is no underflow unless undesired solids are present in the mud, waste of water, oil, and expensive drilling chemicals are held to a minimum. It is practical to operate the Dorrco D-Sander continuously and avoid expensive intermittent increases in sand content.

D-Sanders are engineered for long trouble-free service. Some units have been in service for over two years without major repairs. All parts have been engineered to withstand abrasion from high velocity sand. The entire unit is ruggedly built to take repeated moves without damage.

Whatever benefits you want from de-sanding (faster drilling, more footage per bit, less wear on mud pump parts, easier running of casing) you will get them in full measure with a Dorrco D-Sander. Be safe instead of sorry! Be sure to ask your SWACO representative for full information before you buy *any* de-sander. You will be glad you did.



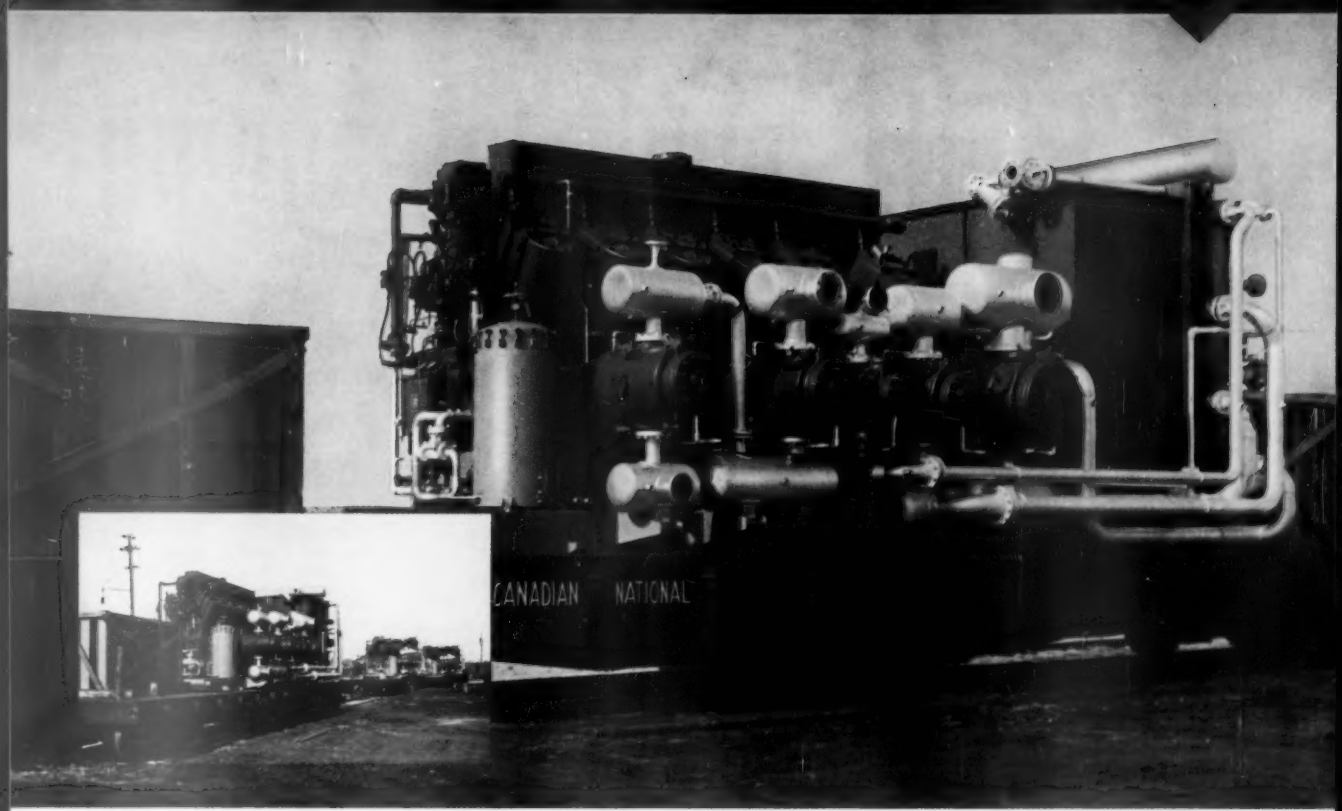
SWACO

SALT WATER CONTROL Inc.

1809 Continental National Bank Bldg. Phone: ED 2-4434 Ft. Worth 2, Texas

BEAIRD-INGERSOLL-RAND Packaged Compressor Plant

Lowest Cost Per Horsepower Installed



CANADIAN BUILT Beaird-Ingersoll-Rand, 660 h.p. 12SVG packaged compressor units have Young radiators with up-draft air discharge. Interstage gas, engine water and lubricating oil cooling sections are built into the radiator. Other sizes from 120 to 660 h.p.

Beaird Packaged Compressors—

MADE IN CANADA

BEAIRD
another AMF product
PACKAGED COMPRESSOR PLANTS

Packaged Compressors are just one of the many products manufactured by Beaird for the petroleum and petrochemical industries. When you are in the market for new equipment or assistance in developing a specialized product . . . contact Beaird for a qualified appraisal or quotation.

PRINTED IN U.S.A.

These three 660 h.p. Beaird-Ingersoll-Rand packaged compressor plants are among the first 18 Canadian-built units to be delivered by Beaird International, Inc., Calgary. This new Beaird subsidiary offers Canadian producers complete sales, service and available manufacturing facilities.

Designed for a major oil company, the units will serve a dual role in gas processing and boosting. Three stages will be used for gas boosting and two stages will handle propane for the chilling process. Another example of the flexibility possible in solving gas production problems, these compressors reflect Beaird's years of design and field experience.

With Canadian facilities, Beaird International offers a single source of responsibility from initial quotation to field service. Beaird offices in Caracas, Venezuela serve South American markets.

Wherever oil or gas is produced, there are skilled Beaird gas engineers to assist in finding an economical solution to your special operating requirements.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana
A Subsidiary of American Machine & Foundry Company

SALES OFFICES: *Shreveport, New Orleans, Louisiana • New York, New York • Tulsa, Oklahoma • Houston, Corpus Christi and Midland, Texas and Cie. Ingersoll-Rand, Paris, France.*

BEAIRD INTERNATIONAL, INC. SHREVEPORT, LOUISIANA • *Sales Offices: Calgary, Alberta, Canada • Caracas, Venezuela.*

How much is EFFICIENT mud de-sanding worth to you?

Comparative tests have shown actual savings of nearly 6000 Dollars per well when Dorrco D-Sanders were used in drilling South Louisiana wells. With results like that, the cost of the D-Sander was paid off fast and overall well costs were substantially reduced.

Many users of other designs, some shop-fabricated and some purchased, have found that mere treatment of mud with a cyclone action is not sufficient to obtain the results reported above.

What was the difference?

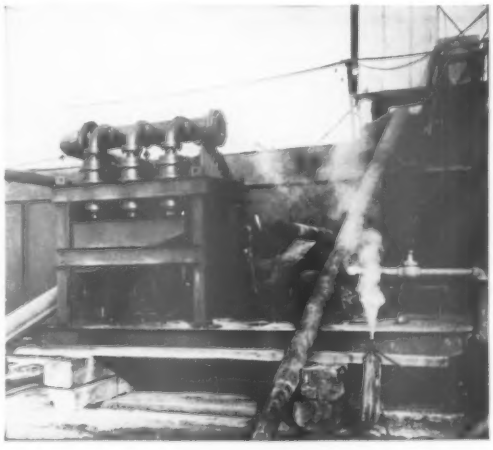
The main difference was the de-sander actually used. The comparative tests mentioned here were conducted using a high-capacity Dorrco D-Sander that had been engineered by Salt Water Control, Incorporated, of Fort Worth.

This unit removes virtually all the sand and much of the finer drilled solids from 600 to 800 gallons of mud per minute. By actual measurement, a Dorrco D-Sander has removed over 1500 barrels of sand and clay from the mud while drilling a single well to 9200 feet, thereby keeping sand content less than one-half per cent and solids low.

An important advantage of the Dorrco cyclone is its "balanced" design. Since there is no underflow unless undesired solids are present in the mud, waste of water, oil, and expensive drilling chemicals are held to a minimum. It is practical to operate the Dorrco D-Sander continuously and avoid expensive intermittent increases in sand content.

D-Sanders are engineered for long trouble-free service. Some units have been in service for over two years without major repairs. All parts have been engineered to withstand abrasion from high velocity sand. The entire unit is ruggedly built to take repeated moves without damage.

Whatever benefits you want from de-sanding (faster drilling, more footage per bit, less wear on mud pump parts, easier running of casing) you will get them in full measure with a Dorrco D-Sander. Be safe instead of sorry! Be sure to ask your SWACO representative for full information before you buy *any* de-sander. You will be glad you did.



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SALT WATER CONTROL Inc.

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ANOTHER first from SIE *and Dresser!*

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SIE, through solid state electronics brings you the latest developments in remote supervision, computing and control.

- **Automatic Sequencing and Load Control**
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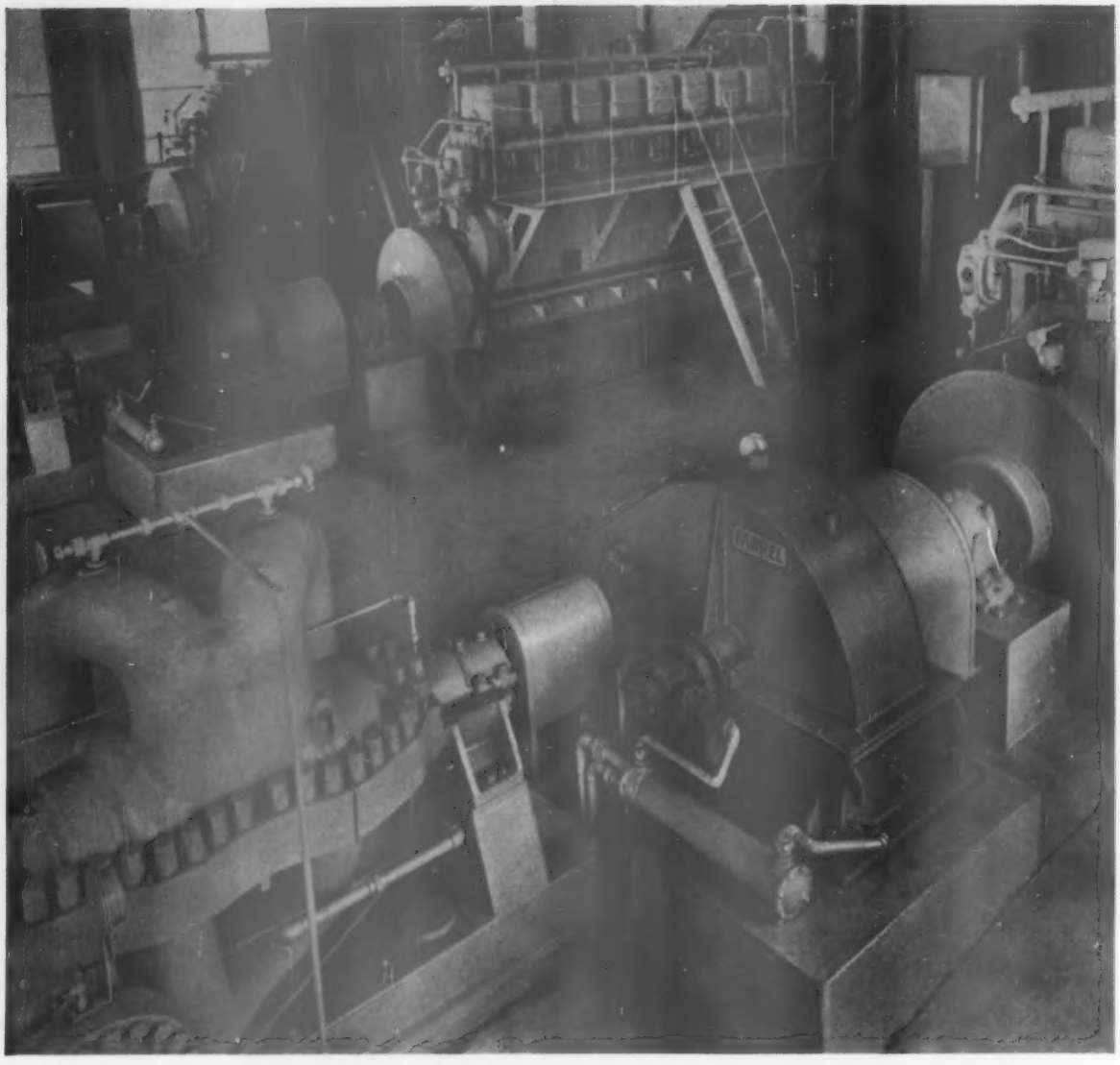

SPEED INCREASERS UNATTENDED

at two full-satellite pipeline pumping stations

Two of the four pumping stations on Evangeline Products System's 16-inch pipeline from Port Arthur, Texas, to Baton Rouge, Louisiana, are each powered by three Nordberg 1700 HP Duafuel engines. These are full-satellite stations, and are attended only during daylight hours. All functions are controlled from the master station at Port Arthur.

The engines drive centrifugal pumps through Farrel gear units, which step up the speed from 500 to 2402 RPM. Farrel gear units have a pipeline history that makes them an ideal choice for a remotely controlled or unattended pumping station. Of the thousands of units installed, since they were first developed in 1932, *not one has ever been known to be replaced.* Even the first units built are still in service.

Send for full details of these long-lasting, trouble-free units. Ask for a copy of Bulletin 451.

FARREL-BIRMINGHAM COMPANY, INC.
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Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
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...pipe with the yearmark!

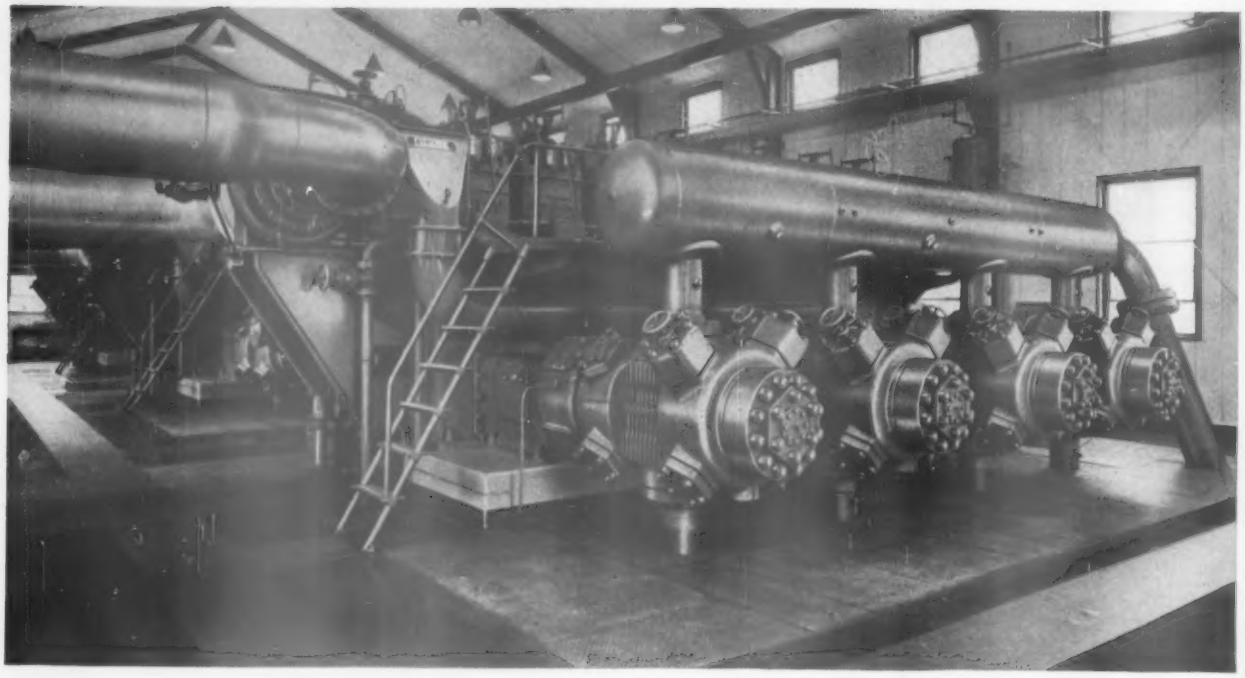
API LINE PIPE IN ACCORDANCE WITH AMERICAN PETROLEUM INSTITUTE SPECIFICATIONS

For Black or Galvanized Pipe, contact your distributor or

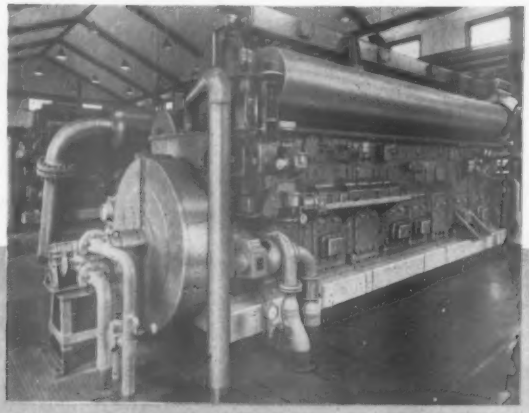
WHEATLAND TUBE CO.

BANKERS SECURITIES BUILDING, PHILA. 7, PA. • MILLS: WHEATLAND, PA. • DELAIR, N. J.

PUSHBUTTON CONTROL



Three Clark 2050 bhp. HBA-8 turbocharged, gas-engine-driven compressors on stream in Texas Eastern's Linden, N. J., Station.



Notice how all functions are designed for automation. Hydraulic pump for radiator fan drive and water pump for jacket water are driven off of the compressor crankshaft.

FROM 40 MILES AWAY

FOR ONE OF TEXAS EASTERN'S NEW COMPRESSOR STATIONS

At Linden, N. J., three 2050 bhp Clark turbocharged, gas-engine-driven compressors are under the complete supervision of an operator 40 miles away. From his control point upstream at Lambertville, the operator starts and stops the engines, adjusts speed, and keeps tabs on engine, compressor and pipeline functions which are displayed on the remote control panel.

Each of the Clark units at Linden may be controlled at from 60% to 110% of rated speed with constant torque loading. The pneumatically operated and remotely controlled compressor valve lifters and clearance pockets permit full utilization of the high flexibility inherent in these reciprocating compressors.

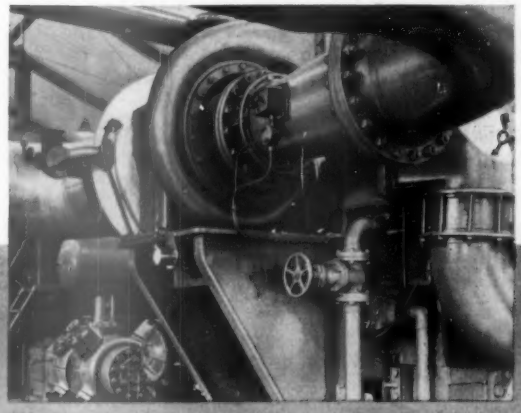
This is just one example of how Clark 2-cycle pipeline compressors are being used for automatic operations. As the trend toward more complete pipeline automation develops, look to Clark for the engineering know-how and the manufacturing experience to produce compressors that readily lend themselves to any degree of sequenced, automatic or remote control.

If you are considering pipeline expansion, it will pay you to learn more about Clark equipment and what it can do for you. Your inquiries are invited. Write:

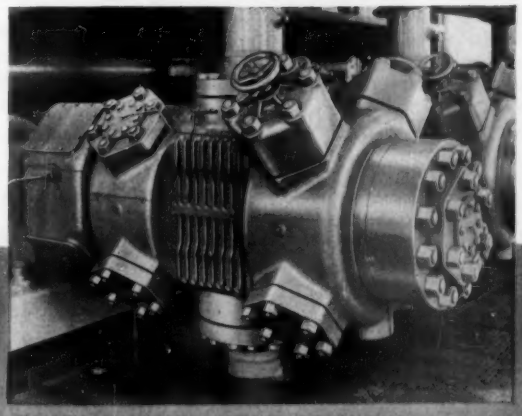
CLARK BROS. CO.
OLEAN, N. Y.

COMPRESSORS
GAS TURBINES

CLARK



Clark Turbocharger and intercooler are mounted on the oil pump end of engines. Increased horsepower and improved fuel economy are direct results of turbocharging.



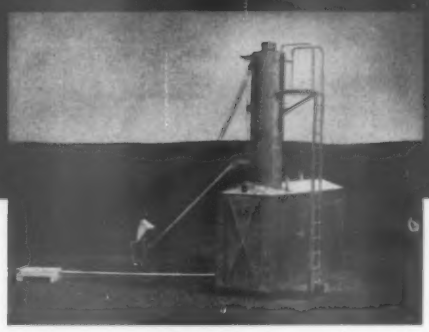
Clark Low Ratio Pipeline Compressor Cylinders are also designed for automation. Pneumatically operated valve lifters and clearance pockets are provided. Hand adjusted valve cap pockets provide additional capacity control.

Proven

IN OVER 500 INSTALLATIONS

ROLO'S CALCIUM CHLORIDE

Gas Dehydrator *



--the revolutionary dehydrator that requires no pump or process heater

The San Juan Basin, Big Piney and the provinces of Alberta and Saskatchewan are among the cold weather areas that have served as proving grounds for the Rolo $CaCl_2$ Gas Dehydrator. Under wintery conditions, efficient gas dehydration is all the more essential, but far more difficult to achieve. Yet, the hundreds of Rolo Units in these areas have performed with marked success.

The Rolo Calcium Chloride Gas Dehydrator employs a long-lasting bed of calcium chloride to remove water vapor from gas streams. Top efficiency is obtained by utilizing the brine, in a series of patented jet trays, to pre-dehydrate the gas before it contacts the chemical bed.

Advantages over competitive systems:

SIMPLICITY . . . No pumps, since regeneration is not required. Only moving parts are the level controls.

LESS HAZARDOUS . . . No process heat required, since there is no regeneration.

ATTENDANCE-FREE . . . Absence of pump and regenerative heater allows unattended operation for long periods—especially important in cold areas and offshore.

LOW OPERATIONAL COST . . . Cost per MMCF is low in comparison with other systems.

LOW INITIAL COST . . . Get our prices and compare.

MAXIMUM DEWPOINT DEPRESSION . . . The ability of calcium chloride as a dehydrating agent, especially with utilization of the brine, is unequalled in water vapor removal.

INTEGRAL SCRUBBER . . . Standard on all models; removes free liquids from the incoming stream.

In the U. S., contact your nearest Bethlehem representative for information and prices on Rolo products. In Canada and for export, see below.

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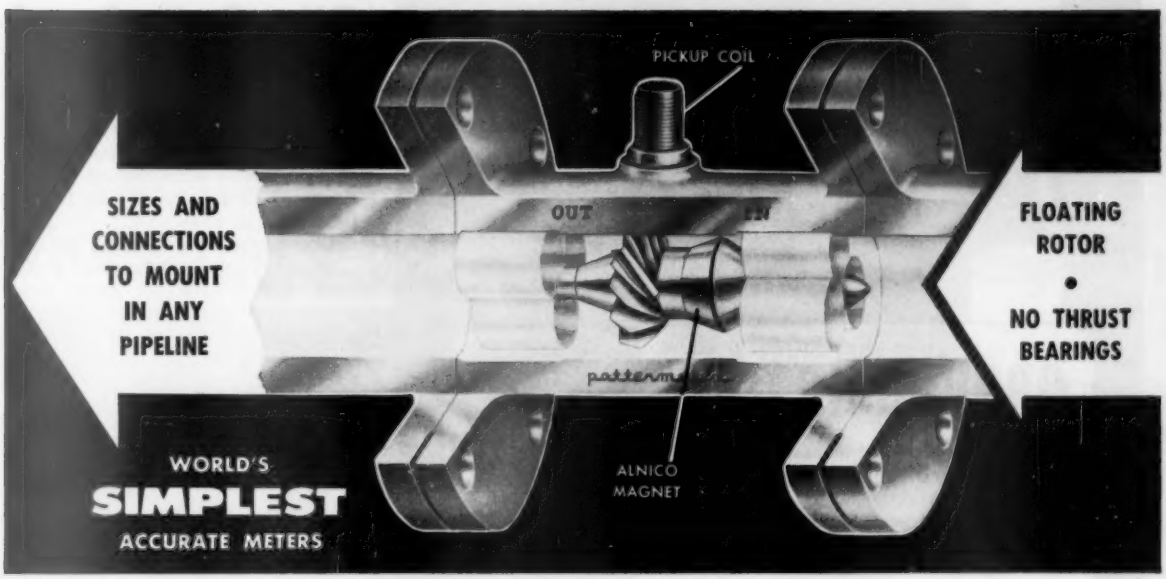
pottermeter BOWSER ESTABLISHED 1885 **0.1 GPM TO 40,000 GPM**

ELECTRONIC TURBINE TYPE METERS



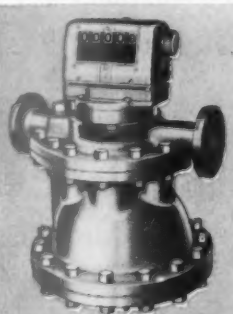
for PETROLEUMS • CHEMICALS • FOODS
PHARMACEUTICALS • INDUSTRY LIQUIDS

A magnet built into the turbine driven rotor generates electric current directly proportional to the flow rate of liquid in the pipe. This impulse is used to activate electronic control and readout equipment near the meter or at remote locations. Accurate over wide range of flow rates and pressures. Handles liquids and gases.

Flow Ranges	to 40,000 g.p.m. and more
Operating Pressures	Unlimited
Temperature Ranges	−455° F. to +1500° F.
Pressure Drop	Virtually Nil
Connections	No limitation
Construction (standard)	Type 316 stainless steel with Carpenter #20 Rotor

READOUT and CONTROL equipment as needed

Potter-Bowser engineers gladly confer with systems engineers to provide data on any application requirements.

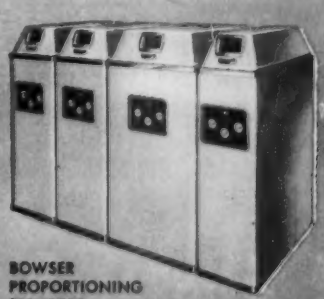


BOWSER XACTO METERS

BOWSER XACTO METERS AND PROPORTIONERS
positive-displacement piston type

Wherever mechanically driven readout and control equipment is indicated, and where positive-displacement metering is needed or costs less, Bowser Xacto Meters (leading all others in industry) are unexcelled for dependability and accuracy. Capacities: 6 GPH to 250 GPM

Xacto Meter equipped proportioners are used to blend two or more liquids in continuous flow at accuracies to ¼ of 1 percent. First in lube oil blending, Bowser proportioners also handle most other liquids used by process industries.



BOWSER PROPORTIONING BLENDERS

Write For Catalog

Potter-Bowser Division BOWSER, INC. Fort Wayne, Indiana

grooved pipe connections ?

name the application — gb has the coupling

GRUVAGRIP®

Made of rugged malleable iron, Gruvagrip is an easily-installed, reusable coupling for grooved pipe with working pressures up to 1,000 p.s.i. Maintains air-tight connection under misalignment up to 7°. Absorbs shock, vibration, ground motion, expansion and contraction.

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Gruvajoint's low-cost companion for pipe with working pressure up to 500 p.s.i. Air, gases, water, oils, chemicals, processing fluids, pulverized minerals . . . G-B couplings are built for use with pipe carrying virtually any type of liquid or material.

RIGI-GRIP ®

The NEW G-B coupling for grooved pipe applications where complete rigidity of connection is desired. Rigi-Grip also is designed for pipe with working pressures up to 2,000 p.s.i. Ideal for tank battery hookups, LACT units, production headers and complete waterflood piping systems.

AND, G-B OFFERS YOU A COMPLETE, COMPANION LINE OF DEPENDABLE, FREE-FLOWING FITTINGS

G-B COUPLING PRODUCTS ARE AVAILABLE AT LEADING SUPPLY STORES EVERYWHERE

GUSTIN-BACON Manufacturing Company

210 W. 10th St. Kansas City, Mo.

Thermal and acoustical glass fiber insulations • Molded glass fiber pipe insulation

They Say—

Off or On the Beam?

Idea has merit

Dear Sir:

I enjoyed the George O. Williams article in the June 15 Journal very much: ("Here's What Surface Electric Records Can Tell You About Drilling Horizons," p. 154).

I have been working along the lines outlined in the article for several years, but I have not made much progress.

I think Williams is on the right track and the idea certainly has merit. I think that much work needs to be done to perfect the system.

Lacie J. Thomas
Tyler, Texas.

Strictly doodlebug!

Dear Sir:

I have come in contact with several doodlebuggers in my few years as a geologist, but I never dreamed that I might see one publish his methods in The Oil and Gas Journal. The article "What Surface Electric Records Can Tell You About Drilling Horizons," by George O. Williams (OGJ, June 15, p. 154) quite amazed me.

Several years ago I chanced to meet Mr. Williams in Los Angeles. On that occasion, I learned enough about his electric-logging methods to completely discredit them of being capable of producing the results he claims. The principal points where his methods fail can be enumerated as follows:

1. He used a signal amounting to only a few milliwatts to measure resistivities in volumes of earth amounting to goodly portions of a cubic mile. The source was an ordinary radio B battery commutated to give a signal of interrupted d.c. The noise to signal figure of his system must have been astronomical.

2. His surveys were nonrepeatable. According to Mr. Williams himself, his surveys conducted over the same route two or more times failed to give logs that had any noticeable similarity. This indicated that the actual values he was plotting represented some kind of electrical noise.

3. His logs were noncorrelatable. Mr. Williams claimed that he could correlate his surface electric logs with ordinary oil well electric logs from nearby holes. Another geologist and I checked some such supposed correla-

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SUPER-SERVICE

valves and seats will cut your costs, too.

Each type of valve and seat is designed to be the best for its service. And even more, each Mission Valve and Seat is *built* to be the best. Advanced metallurgy, precision machine tools, and rigid quality control combine to cut replacement costs, to increase the efficiency of pump operation.

Mission MUD MONARCH® Valves and Seats *for extremely high and medium pump pressures.* Unique design with exclusive seal ring results in exceptional performance as this ring seals effectively when body and seats are severely worn. Compound 308® and Compound 711 inserts are available.

Mission SUPER-SERVICE® Valves and Seats *for medium pump pressures.* Four crossarms provide extra strength and large striking surface, assuring long valve seat life without restricting flow area.

Mission SILVER TOP® Valves and Seats *for low and medium pump pressures.* Replaceable, wear-taking bushing greatly reduces valve seat replacement costs. The famous Compound 308® inserts are interchangeable with Mission SUPER-SERVICE Valves.

Mission Valves and Seats are available for all popular makes of reciprocating pumps. Buy them anywhere through your supply store.

For over thirty years - quality built in to last

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59-102

SPEEDKOTE and SPEEDWRAP
. . . from Midwestern

Speedkote and Speedwrap, two new *GLASFAB*® products designed specifically for fast set-up time, are the latest additions to the Midwestern line.

SPEEDKOTE is a quick-set asphalt with excellent adhesive properties, high dielectric strength and good soil and mar resistance. Speedkote may be brushed, trowled or sprayed on the pipe. Drying time is approximately 30 minutes per coat.

SPEEDWRAP is a prefabricated pipe joint cover made of one ply of "Glasfab" and 25# bitumen (either asphalt or coal tar) laminated to a sheet of 90# polyethylene faced kraft paper. Speedwrap comes in 18" and 24" widths and is pre-cut in lengths to fit the pipe being wrapped.

Speedkote and Speedwrap are the two latest developments in Midwestern's field-proven "Glasfab" line. The original "Glasfab", a wholly inorganic loom-woven glass fabric, has proved to be an ideal handwrap for pipe joints, extensions, hot spots and holidays . . . with either hot or cold applied coatings.

A Midwestern representative would like to show you the advantages of new Speedkote and Speedwrap.
For complete details contact the Midwestern Man nearest you . . . TODAY!

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- Des Moines, Ia.
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- Caracas, Venezuela

tions that he had marked between some of his logs and ordinary E logs, and we could find no correlation at all. We checked correlations he had marked between his own logs and could not find any correlation.

4. His method appears to be designed, by accident, to measure contact noise between electrodes and ground. He used four electrodes in making a survey, two electrodes to pass the electric current into the ground, and two electrodes to pick up the signal from the ground. Mr. Williams told us that he was never able to pick up any signal unless one of the pickup electrodes was placed in the ground within a few inches of one of the current electrodes. He also told us that the ground had to be dry for him to be able to make a satisfactory log. Apparently, the values he plots to make his logs represent the random variations in resistance between the dry ground and the electrodes.

Mr. Williams' perseverance with his electric-logging methods indicates imagination and faith beyond understanding.

Robin B. Willis
Geologist-Engineer
Jefferson Lake Petrochemicals
of Canada, Ltd.

Author answers

(In response to Reader Willis' comments Author George Williams writes:)

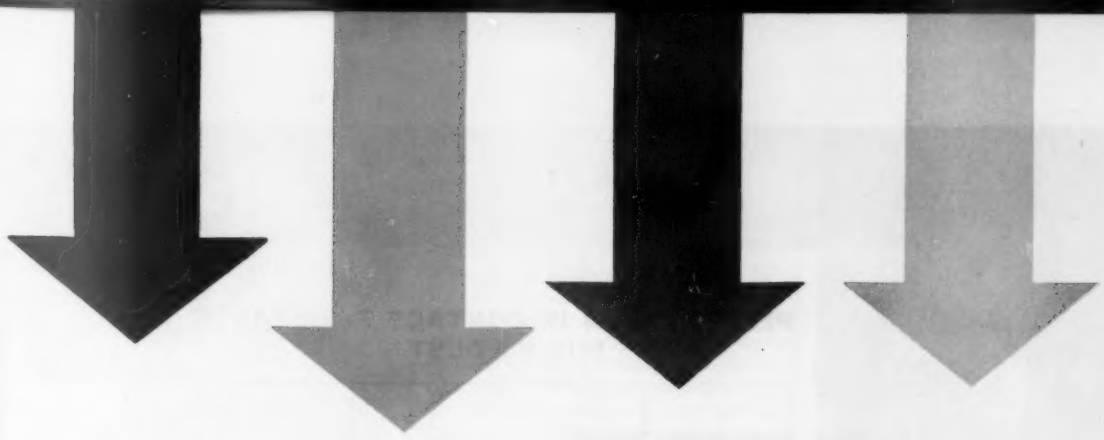
Dear Sir:

I must protest some of Mr. Willis' comments:

In item 2 he says that the surveys are nonrepeatable. This is just not true. The first step in the development of the technique was to establish repeatedly that observations would be duplicated, under similar and under different conditions of weather and temperature, and by different observers. Duplication of records is an imperative requirement in assessing the virtue of the mechanical operation—it is, of course, no proof whatever of the depth thesis.

His item 3, relative to the noncorrelatability of records, concurs, to my distress, with the opinions of a few outstanding geologists for whom I have the highest admiration, though we disagree. Two geologists with whom I have worked demand the records without my correlation marks, believing they are more competent than I to make correlations. Subsequent results have often justified their opinion. Usually the geologist involved and I cooperate in making correlations.

A flagrant misquotation in item 4 states that "we were never able to pick up a signal unless one of the



When you need cathodic protection for underground structures it's the high silicon iron, DURIRON, that counts!

IN ALL ORDINARY CASES . . . DURIRON IS JUST AS GOOD AS GRAPHITE; AND IN THE REALLY TOUGH CASES, DURIRON ANODES ARE BETTER

1. Unexcelled corrosion resistance
2. Good electrical properties
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5. Easy to install

STANDARD DURIRON ANODE SIZES

Type Anode	Size	Area Sq. Ft.	Weight (Lbs.)	General Application
B	1" x 60"	1.4	14	Fresh Water
C*	1½" x 60"	2.0	25	Ground Bed
D	2" x 60"	2.6	46	Ground Bed
E	3" x 60"	4.0	115	Salt Water
G	2" x 9"	0.4	5	Ducts
J	3" x 36"	2.5	80	Salt Water
M	2" x 60"	2.8	57	Salt Water

* Applicable also in fresh water service. Should not be used in ground beds without backfill.

Go all the way with the high silicon iron, Duriron*. Its superiority in marshlands, at river crossings, and wherever backfilling is impractical or imperfect has been proved without question. And in all perfect backfill cases (where the anode is merely the conducting rod) Duriron serves exactly the same purpose as graphite, and just as well.

Duriron anodes have proven their superiority for the cathodic protection of pipelines, drilling rigs, well casings, storage tanks, gathering lines, communications cables, and similar systems. For positive protection, insist on DURIRON.

** For high chloride environments, The Duriron Company manufactures the molybdenum containing high silicon iron, Durichlor.*

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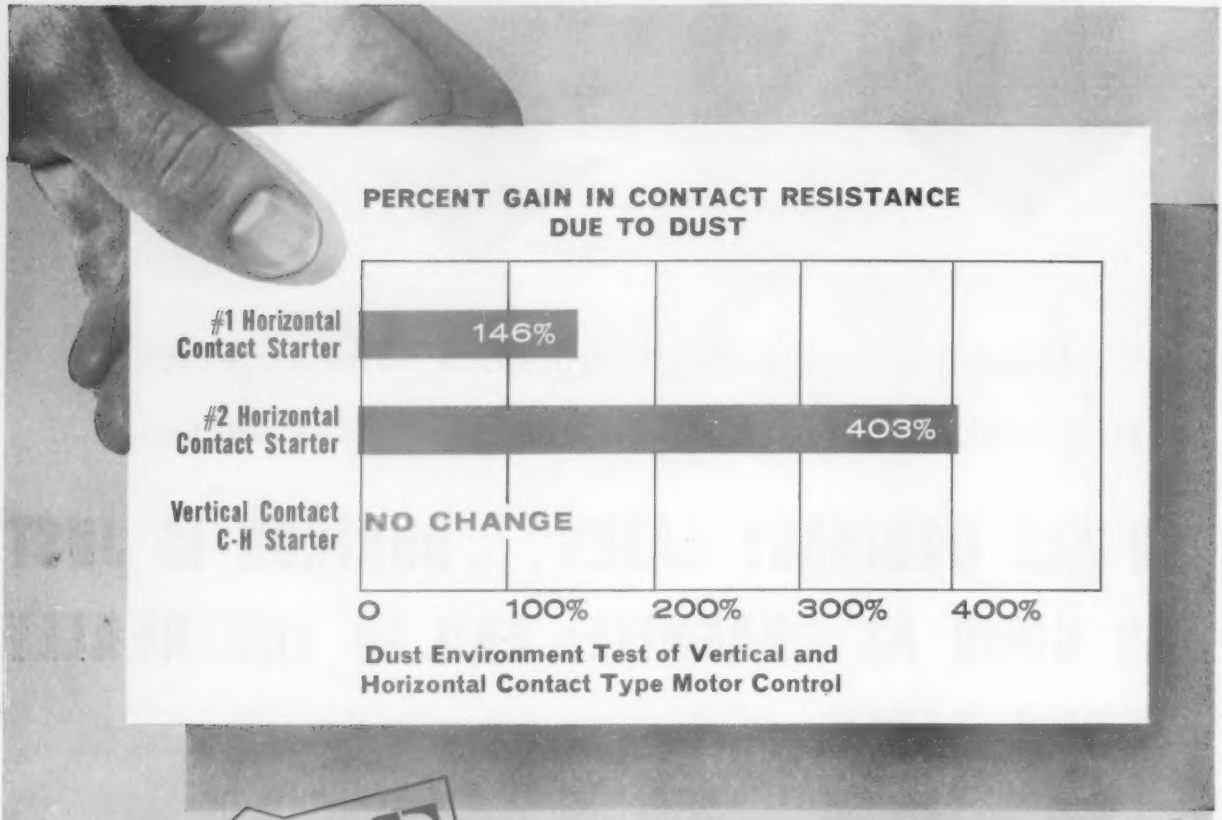

PROOF OF PERFORMANCE

Vertical *dust-safe* contacts keep Cutler-Hammer Three-Star Motor Control working better...working longer

Standard dust chamber used to compare performance of vertical and horizontal contact type motor starters in dust environments

"Dust can't collect on a vertical surface." This is a simple fact, but an important one to users of motor control. To function properly the contacts in motor control *must* stay clean, free from all forms of dust under all operating conditions. And because dust can't collect on a vertical surface, only vertical contacts are truly *dust-safe*. For proof look at the results of this test.

Both horizontal and vertical contact type motor starters were subjected to a dust environment for four hours. The vertical contacts proved their immunity to dust by maintaining a constant contact resistance. But the contact resistance of horizontal contacts skyrocketed, and as contact resistance increases so does heating, pitting and wear, resulting in rapid contact failure.

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CUTLER-HAMMER CONTROL C-H

Vertical *dust-safe* contacts are standard in all Cutler-Hammer Three-Star Motor Control

NON-REVERSING STARTERS AND CONTACTORS

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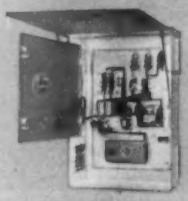

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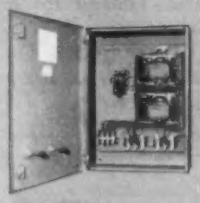
REVERSING AND MULTI-SPEED STARTERS AND CONTACTORS



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pickup electrodes was placed within a few inches of one of the current electrodes." An early demonstration contradicts this statement. I was asked to establish the current input on the surface of the ground, then go into a mine to a depth of a little over 500 ft., set the pickup electrodes and see if any current reached that depth. It did so—with a gallery of operators surrounding the ponteniometer—demonstrated a pickup of current when the surface circuit was activated—satisfied the clients—and proved absolutely nothing.

Another misquotation on a vital point is without foundation: "He told us that the ground had to be dry to make a satisfactory log." The statement is incorrect in detail and in total. I cannot imagine what wording in the discussion, or in any discussion I have had with any person, could provoke such a misunderstanding.

George O. Williams
Geologist
Oklahoma City.

(Editor's note: The Journal has previously and will continue to present unusual exploration techniques to its readers. This does not necessarily constitute full endorsement by the Journal of all of the methods presented—they are offered for the reader's evaluation.)

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

JULY

16-17 University of Michigan, research conference on underground storage of natural gas, Ann Arbor, Mich.

27-31 University of Minnesota, continuation course, techniques of chemical infrared spectroscopy, Minneapolis.

AUGUST

3-7 University of Minnesota, continuation course, chemical interpretation of infrared spectra, Minneapolis.

6 Southern Gas Association, American Gas Association, public relations roundtable conference, Heidelberg Hotel, Jackson, Miss.

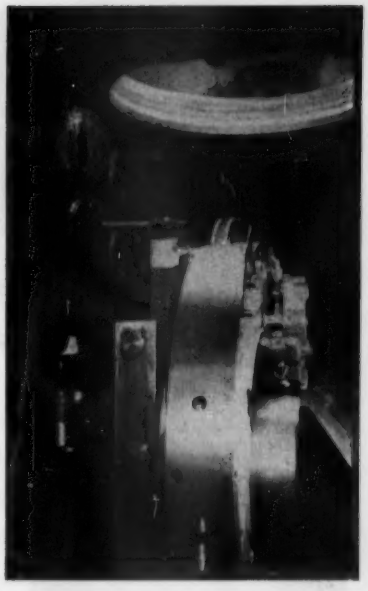
7 Southern Gas Association roundtable conference on pipeline operation and maintenance, St. Anthony Hotel, San Antonio, Tex.

10-13 Society of Automotive Engineers, national West Coast meeting. Hotel Georgia, Vancouver, B. C.

10-28 Louisiana Polytechnic Institute, Lou-Ark section of AIME, graduate summer session in reservoir engineering, Louisiana Polytechnic Institute, Ruston, La.

12-15 Billings, Mont., Geological Society, tenth annual field conference, Disturbed Belt area of northwestern Montana, registration, August 12, Great Falls, Mont.

23-26 American Institute of Electrical En-



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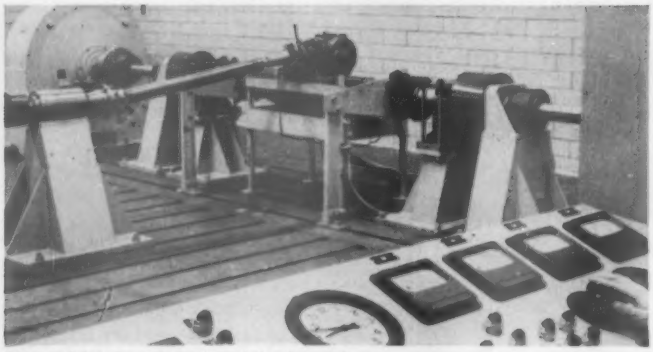

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TIMKEN®

tapered roller bearings

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gineers, sixth electrical conference of the petroleum industry, Wilton Hotel, Long Beach, Calif.

24-25 North Dakota Oil and Gas Association, annual meeting, Grand Pacific Hotel, Bismark, N.D.

24-26 West Virginia University, annual Appalachian gas measurement short course, Morgantown, W. Va.

26-28 Pennsylvania Grade Crude Oil Association and Pennsylvania State University, twenty-first technical conference on petroleum production, Penn State campus, University Park, Pa.

27 Oil Centennial Day, Titusville, Pa.

SEPTEMBER

9-11 Pacific Coast Gas Association, annual meeting, Ambassador Hotel, Los Angeles.

9-12 Intermountain Association of Petroleum Geologists, annual field conference, western high Uintas, registration, September 9, Provo, Utah.

10-12 Magic Plains Oil Exposition, Borger, Tex.

14-16 Texas Mid-Continent Oil and Gas Association, annual meeting, Rice Hotel, Houston.

16-18 Wyoming Geological Association, field conference, Big Horn Basin, registration, Cody, Wyo.

16-18 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

17 Natural Gasoline Association of America, Rocky Mountain regional meeting, Wyoming-Gladstone Hotel, Casper, Wyo.

20-23 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Rice Hotel, Houston.

21-25 Instrument Society of America, annual instrument-automation conference and exhibit, International Amphitheater, Chicago.

23-24 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-25 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division annual meeting, Roosevelt Hotel, New Orleans.

27-29 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Leamington, Minneapolis.

29-30 Western Petroleum Refiners Association, management seminar, Western Hills, Waggoner, Okla.

28-Oct. 1 American Welding Society, fall meeting, Sheraton-Cadillac Hotel, Detroit.

29-Oct. 1 National Association of Corrosion Engineers, western region conference, Bakersfield Inn, Bakersfield, Calif.

OCTOBER

1-2 National Association of Corrosion Engineers, southeast region conference, Jacksonville, Fla.

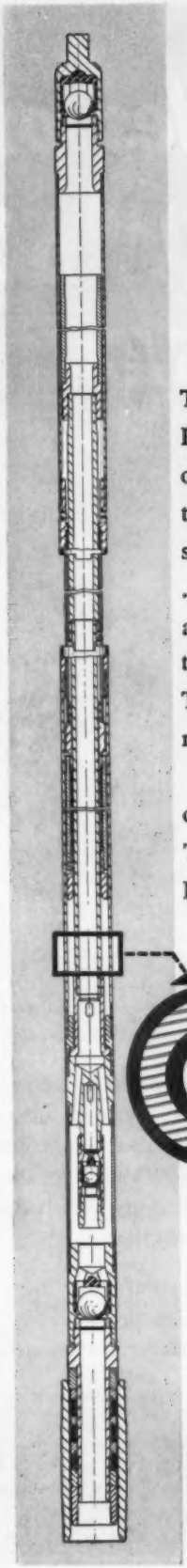
2-3 Association of Desk and Derrick Clubs of North America, eighth annual convention, Hilton Hotel, San Antonio, Tex.

4-7 Society of Petroleum Engineers of AIME, fall meeting, Memorial Auditorium, Dallas, Tex.

5-7 American Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

5-7 National Association of Corrosion Engineers, northeast region conference, Lord Baltimore Hotel, Baltimore.

5-10 Society of Automotive Engineers,



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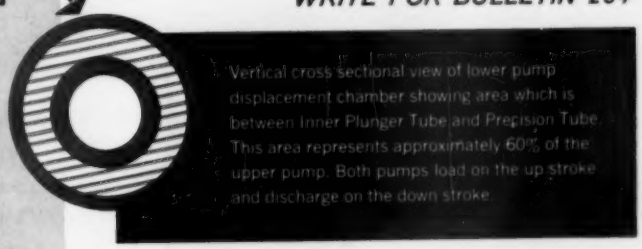
WRITE FOR BULLETIN 204



Vertical cross sectional view of lower pump displacement chamber showing area which is between Inner Plunger Tube and Precision Tube. This area represents approximately 60% of the upper pump. Both pumps load on the up stroke and discharge on the down stroke.

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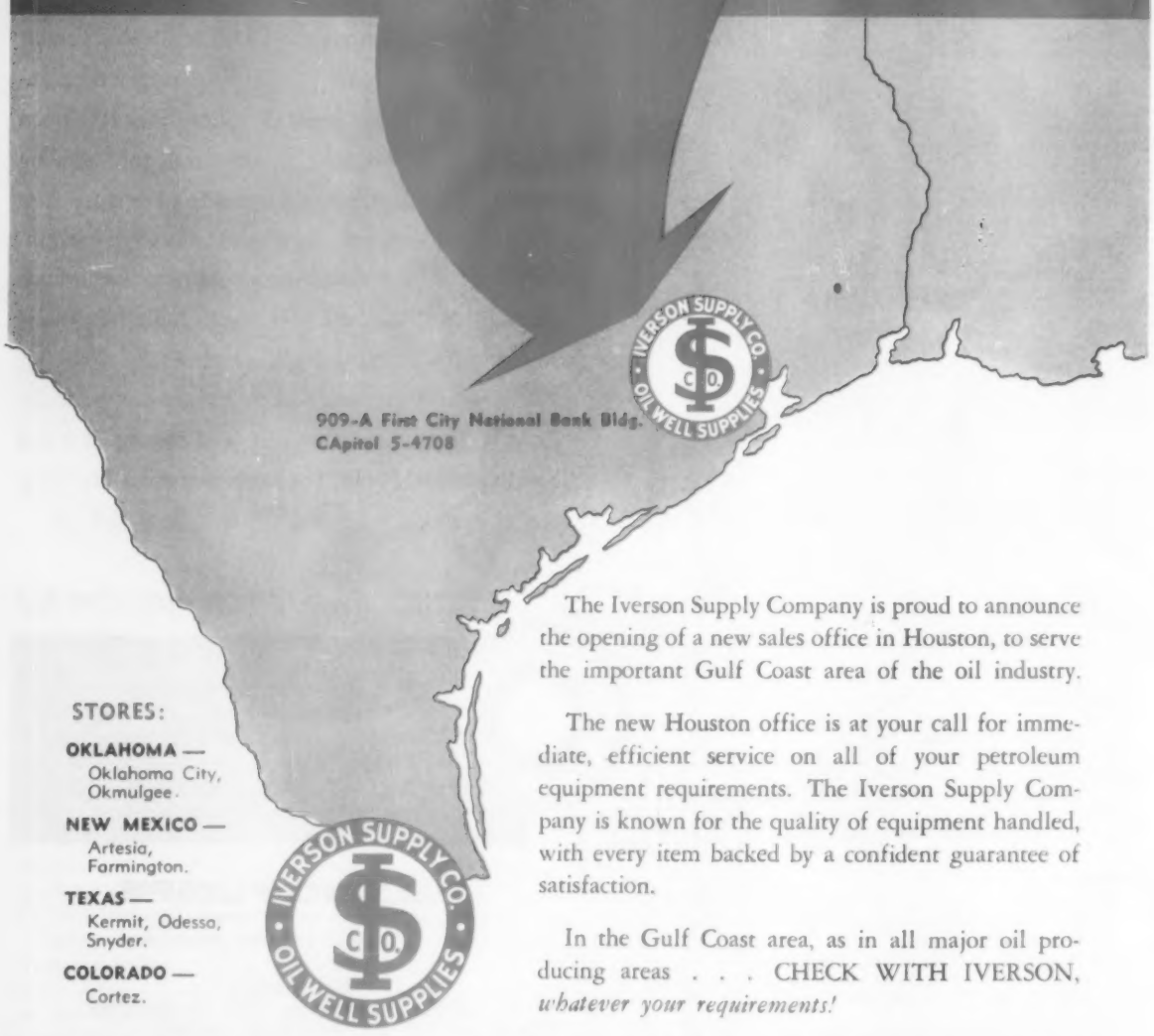

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national aeronautic meeting, aircraft manufacturing forum, and aircraft engineering display, The Ambassador, Los Angeles.

7-8 Western Petroleum Refiners Association, fourth annual stream pollution and waste disposal conference, Broadview Hotel, Wichita.

7-10 Rocky Mountain Association of Geologists, eleventh annual field conference, Saratoga Inn, Saratoga, Wyo.

8-9 California Natural Gasoline Association, annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

8-10 American Association of Petroleum Geologists, Southwestern Federation of Geological Societies, second annual regional meeting, Coliseum, Lubbock, Tex.

8-10 Exploration Drilling symposium, sponsored by University of Minnesota, Colorado School of Mines, and Pennsylvania State University, University Park, Pa.

8-11 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

11-13 American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.

11-16 American Society for Testing Materials, Pacific area national meeting, Sheraton - Palace Hotel, San Francisco.

12-15 National Association of Corrosion Engineers, south central region conference, Cosmopolitan Hotel, Denver.

13-14 Seventh Annual Gas Measurements Institute, National Guard Armory, Liberal, Kans.

20-22 American Standards Association, national conference on standards, Sheraton-Cadillac Hotel, Detroit.

20-22 National Association of Corrosion Engineers, north central region conference, Cleveland.

20-22 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Sheraton - McAlpin Hotel, New York.

22-23 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin section, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

23 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

26-27 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-27 Independent Natural Gas Association of America, annual meeting, Westward Ho Hotel, Phoenix.

26-28 Society of Automotive Engineers, national transportation meeting, La Salle Hotel, Chicago.

28-29 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28-29 Armour Research Foundation of Illinois Institute of Technology, annual computer applications symposium, Morrison Hotel, Chicago.

28-30 Society of Automotive Engineers, fuels and lubricants meeting, La Salle Hotel, Chicago.

28-30 American Association of Petroleum Geologists, Mid-Continent regional meeting, Broadview Hotel, Wichita.

29-30 Oil Recovery Symposium on Southwest Texas, sponsored by southwest section of AIME and Texas Petroleum Research Committee, Driscoll Hotel, Corpus Christi, Tex.

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3 TO 1

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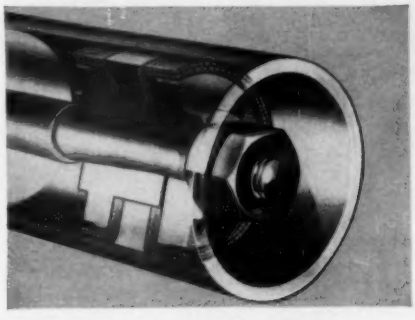

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JOURNALLY SPEAKING

Could This Be?

IN THE YEAR 2059, curious historians examined the oil industry to determine why it was that, early in its second century, it ceased to be a competitive, free-enterprise business and came under the complete regulation of the federal Government.

With ironic amusement they dated the beginning of the change in 1959—the very year the industry was celebrating its first 100 years with much fanfare attributing its progress and prosperity to the fact that it had avoided federal control.

It was in 1959, the historians noted, that the Government first began to regulate oil imports. That action, subsequent events showed, was the first link in a chain of developments that either forced or invited the Government to take a successively increasing part in management of the oil business until it had complete control.

Apparently it was not a deliberate plan. One thing just led to another. The historical records back in 1959 were pretty hazy as to the reasons why the Government chose that particular method to regulate imports.

The Government announced that it was limiting imports to protect the national security. The reasoning appears to have been that when the volume of oil offered for sale exceeded the rate of consumption, prices would fall, exploration would languish, marginal fields would be abandoned before full recovery, and the domestic oil industry would become too small and weak to supply the nation in time of emergency.

To accomplish its announced objective of keeping the industry healthy, the Government adopted two devices.

The first was to prorate imports to a certain percentage of market demand. This was a device that had already been developed by the industry and had been used with some success in stabilizing operations and maintaining reserves.

The second was a constant surveillance of oil prices to make sure that the objectives of imports control were being attained. The 1959 records indicate that at that time everybody assumed that oil prices would go up with imports reduced and that the Government would have to take action to keep them no higher than the point where the domestic industry as a whole could again show a profit.

All during 1959 and in subsequent years a lid was kept on imports. But there was still such a surplus of oil that prices continued to go down, exploration remained at a low ebb, and scores of independent producers and refiners sold out to stronger companies to avoid bankruptcy.

The Government's price-surveillance operation soon determined that even with import controls the domestic industry lacked the health needed for national security because there was still a price-depressing surplus.

That is when the Government decided that if proration was proper for imports it should also be applied more widely to domestic operations. It concluded that proration to market demand was a sound principle, and began to put pressure on all states to do more prorating.

But some states refused to enact proration laws. And some states with such laws did not apply them in ways to prevent excess production. All the states argued among themselves over their fair share.

So, to make its imports-control plan function, the Government assigned quotas to the various producing states and took over market-demand proration from them. And since proration and conservation are so closely allied, the Government, within a few years, was controlling drilling, spacing, unitization, production methods, and all related activities.

Then, of course, it was obviously logical for the Government to regulate refining and marketing, too, in order to prevent wasteful and self-destructive practices that undermined national security.

It was an interesting web of developments that those 2059 historians unraveled about the oil industry in the 1960's.

—*Henry D. Ralph.*

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Oversupply explains the urge to tie up markets

THE PENDING MERGER of Texaco and Superior points up a trend which has been getting increasingly stronger for several years and which promises to bring widespread changes in the structure of the oil industry in the United States.

That is the push for controlled market outlets.

Many factors motivated this particular merger, but on Superior's part a big one undoubtedly was its present lack of assured markets. This same problem underlies many other recent mergers of oil companies.

THIS IS A NATURAL CONSEQUENCE of the condition of excessive producing and refining capacity which has existed almost everywhere for several years and which seems likely to continue for some time in the future.

A company able to produce more oil—either crude or refined— than it is able to sell naturally tries to tie up an assured market outlet either by long-term contract or by ownership control. An integrated company, pinched for earnings in all divisions, naturally sees little point in buying crude or refined products from others when it has idle capacity of its own.

It is the chronic oversupply of oil that explains why major and minor integrated companies race to build or buy more filling stations, why independent refiners seek long-term tie-ups with marketers lacking their own supplies, why independent producers feel so insecure in their dealings with crude purchasers.

There are too many filling stations for the size of today's market because there are too many producing wells and too much refining capacity.

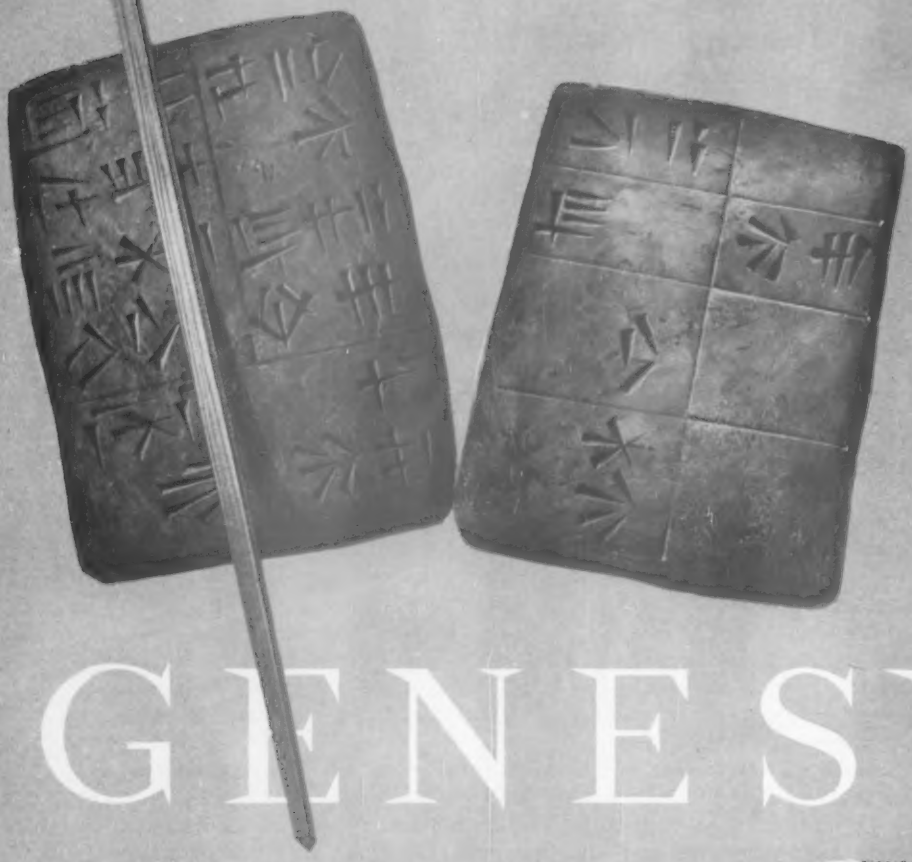
This doesn't necessarily mean that independent producers, independent refiners, and independent marketers must integrate or die. But their freedom of choice and opportunity for making deals is narrowing as integrated companies, both large and small, move toward more balanced operations and more control over facilities to market their own output.

ECONOMIC FORCES are behind this trend, and only economic forces can reverse it. The real cure is for the growth of demand to overtake the growth of supply.

In the meantime it will help mightily to keep checkreins on the volume of supply reaching the market. In the United States this can best be accomplished by more widespread proration of crude production and enforcement of ratable take.

When integrated operators must buy some supplies from others to fill their current needs, they will not feel such economic compulsion to control additional marketing facilities. Proration of crude supply at the wellhead would seem to be the salvation of independent producers, independent refiners, and independent marketers alike.

PRACTICAL PROCESS CONTROL



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Filling the void in practical digital control, this Unit Memory Processor (UMP) is the heart of a Genesys Process Control System, uses the best combination of general purpose and incremental computer techniques.

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What's Involved in the Refinery Strikes

Who's Struck	Where	Capacity (bbl. daily)	Men idled	Issues
Amoco	Texas City	148,000	1,250	Working conditions
Amoco	El Dorado, Ark.	40,000	373	Working conditions
Indiana Standard	Sugar Creek, Mo.	76,000	760	Working conditions
Strike Threatened				
Lion	El Dorado, Ark.	33,000	280	Wages, benefits

Work Assignments Close Three Plants

- Indiana Standard stands firm on who will handle work assignments as third plant closes within 2 weeks. Producers in several states are hurt as crude buying is cut due to the shutdowns.

LABOR PEACE in the oil industry came to an abrupt end last week, shattered by a series of strikes at three major refineries.

All involved one basic issue: Who's going to run the refineries? The unions? Or management?

The struggle centered at three plants operated by Indiana Standard and threatened an Arkansas refinery of Lion Oil near one of the struck plants.

The shutdowns left 2,383 men out of work and shut off about 230,000 bbl. daily of crude refining capacity. An additional 280 men will lose jobs and 33,000 bbl. daily more capacity will be affected if the Lion strike materializes.

This represents an estimated loss to crude producers of about $890,000 daily and to the workers themselves of about $193,000 weekly.

Evidence, however, is that the loss on both sides will be much greater if labor, led by the Oil, Chemical and Atomic Workers International Union, really has elected to have a showdown with oil officials over refinery management.

Company executives give the appearance of a determination this time to regain control over work practices in their plants. They privately feel that in the years ahead the difference between profit and loss may be their ability to increase worker productivity and efficiency. But to do this, they must be able to reap the full benefits of new machinery and automatic controls which save labor.

The strike action came suddenly but actually climaxed weeks of negotiations which came to grief against Indiana Standard's determination to control the working conditions at its refineries.

OCAW workers first shut down the Texas City and El Dorado, Ark. refineries of American Oil Co., an Indiana Standard subsidiary. A strike at the parent company's Sugar Creek, Mo., plant followed.

In each case the major issue was plant manning and job assignments.

An exception to this pattern developed, however, when 280 union workers at Lion Oil's El Dorado refinery also voted to strike for higher wages and other benefits. They are members of the International Union of Operating Engineers.

Lion has offered a 3% wage increase plus 6 cents an hour amounting to about 5%. Union demands have not been made public.

In addition, company's right to hire outside contractors on improvement programs is an issue. The union wants to use its own members on contract jobs. Lion currently is expanding its refinery to 33,000 bbl. daily capacity from 29,000 bbl. daily and an outside firm has been engaged for the work.

The issues . . . Amoco's El Dorado plant manager, H. H. Heiss, told newsmen that the union wants a "bigger share of management in the plant and a veto over basic decisions."

Heiss said that OCAW representatives turned down a company proposal to sign the old labor contract and operate under it another year.

Instead, he said the union men stuck with their demands asking that such time-honored practices be discontinued as:

. . . Contracting unusual plant maintenance jobs.

. . . Bringing in outside help during turnarounds.

. . . Controlling the number of people on various jobs.

Heiss said Indiana Standard gave the union assurance it had no intention of laying off workers during the contract period or of changing contract provisions for workouts.

He said the El Dorado workers are some of the best paid in Arkansas. They average $112 weekly compared with the Arkansas average of $67 weekly. They stand to lose $45,000 for every week they're out of work.

Supervisors at work . . . At Amoco's Texas City plant, Manager Bruce F. Babin took action to keep the refinery producing 30,000 bbl. daily.

Supervisory employes were put in charge of operating one crude unit at the strikebound plant. Babin took the position that both the union and the company will benefit from this attempt to help Amoco's customers.

"It seems quite clear that retaining our customers is the best way to protect jobs here at the refinery and to make sure they still exist after the strike is over," he said.

OCAW called the Texas City strike after contract bargaining broke

down on the issue of work assignment and job classification.

An OCAW spokesman outlined the series of events leading to the July 1 walkout.

He said refinery management laid off 400 workers since 1957, and changed job descriptions so that the 1,250 remaining workers had to perform the tasks formerly done by the 1,650 employes. OCAW in turn proposed that all job descriptions be restored to their status as of July 1, 1957, with changes possible only by company-union agreement and that Amoco adjust classification pay rates consistent with the increase in the work load.

After the strike started, the OCAW took exception to operating the Texas City plant with supervisors. The union held the supervisors actually were not qualified to operate the plant and that the action "turns them into scabs."

Babin, however, stuck to his guns. He replied the supervisors were "fully qualified" and that management is confident they will operate the plant safely and efficiently.

Babin in a letter to civic leaders in Texas City area called the strike "a futile and unnecessary action." He said it can lead only to loss of pay and hardship to union members, loss of $108,000 weekly to the community, and possible inconvenience to customers.

Babin said the union had demanded that it be given veto power over management, explaining:

"The union demanded it be given a voice in what operations shall be performed, how many people it will take to do each job, and who may and may not perform even the most insignificant and incidental tasks.

"The company, of course, refused to give in to these demands. The responsibility for the safe, efficient, and profitable operation of this refinery is something that can not be bargained away."

Sugar Creek story . . . Workmen shut down the big Indiana Standard refinery at Sugar Creek near Kansas City, Mo. for similar reasons.

Refinery Manager P. C. Livesay said the dispute hinged on refinery work rules and conditions. Salary is not a dispute.

The strike came while OCAW was trying to write its first contract with Indiana Standard at Sugar Creek. Until last March, all Sugar Creek workers had been represented by the Central States Petroleum Union, an independent organization. At that time the OCAW won bargaining rights for the operating and maintenance employes while the clerical workers voted to remain with CSPU. This apparent split explains why the clerical employes refused to strike last week at Sugar Creek and crossed OCAW picket lines to reach their jobs.

Repercussions . . . Crude producers in three states felt the effects of the strike immediately when Indiana Oil Purchasing Co. stopped buying.

Indiana Oil Purchasing halted all buying in southern Arkansas and northern Louisiana and began 40% purchaser proration on the Louisiana-Texas Gulf Coast and in Scurry County, West Texas.

The action was taken to halt the crude flow to the Texas City and El Dorado plants. All buying was stopped in fields supplying El Dorado because no storage is available there. Texas City storage will permit partial purchases for that plant.

Crude from Oklahoma, West Texas, New Mexico, and the Rockies is used at the Sugar Creek refinery. R. L. Pielsticker, president of Indiana Oil Purchasing, said a decision on changes in purchasing in these areas, however, still has not been made.

Hoffa at Humble . . . Meanwhile, on another Gulf Coast labor front, the Teamsters Union made a bid for support of workers at the Baytown plant of Humble Oil & Refining Co.

The National Labor Relations Board has set a hearing for July 13 at Baytown to determine which workers will be eligible to vote in an election on the bargaining agent for the plant.

The Baytown Employees Federation, an independent union, has represented the workers for many years. The OCAW recently obtained signatures of 30% of the workers, calling for an election on the bargaining agent.

The International Teamsters Union announced that it has obtained signatures of 10% of the workers and, therefore, will qualify for a place on the ballot.

This would mean that the Teamsters, the OCAW, and the BEF would be on the ballot if an election is held. Also the Houston Bricklayers Union wants to carve out a group of the workers for separate representation at the plant, and it also is seeking a ballot spot.

The Teamsters invasion of the Humble plant is the second effort made by Jimmy Hoffa's union to organize Standard of New Jersey plants. Hoffa currently is trying to organize the workers at the Esso Standard refinery at Baton Rouge, La.

Tidewater and

EXCELLENT PROGRESS is being made toward the merger of Tidewater Oil Co. and Skelly Oil Co., Tidewater announced last week.

George Getty, Tidewater president, said work hasn't yet reached a point where a date for the merger can be set. But he indicated it should fall within the 4 to 8-month period estimated when the merger plan was announced in April.

Five committees are at work evaluating assets and looking for a mutually acceptable stock-exchange ratio. Each committee has a specific area of responsibility.

They are manufacturing, land and reserves, transportation, accounting, and marketing. These five committees report to a sixth committee, composed of Getty, Skelly President John S. Freeman, and a representative of DeGolyer & MacNaughton.

The general committee will make its recommendations to the board of directors of each company before submitting proposals to stockholders.

Big job . . . The business of evaluating the assets in two companies the size of Tidewater and Skelly is tremendous.

Tidewater has enlisted its large computer division in the tasks of evaluating and comparing the thousands of leases and reserves of both companies.

It also involves solving a number of

New Device

JET PLANES will use less fuel, fly greater distances, or carry heavier loads in the future. This enviable choice faces the airlines as the result of a new, relatively minor modification in engine design.

The modification varies in type and title according to the manufacturer. United Aircraft calls it the "Turbofan," General Electric, the "Aftfan," and Rolls Royce, the "Conway Bypass."

All three enable the engine to gulp more air. As a result they consume less fuel and develop greater thrust. The device also makes possible the elimination of noise suppressors and enables the planes to use shorter runways.

Less fuel . . . Estimates of possible fuel economy run as high as 20%. This could mean a marked reduction in commercial jet-fuel requirements.

Skelly Making Progress Toward Merger

operating and financial problems, Getty said.

For one, a complete inventory of both companies' properties and assets must be taken in order to arrive at a common basis for evaluation. Also, earnings of both for years past must be related on a common basis and an agreeable means of forecasting future operations and earnings decided.

John S. Freeman

George F. Getty

Why the merger . . . Why do two such large and successful companies in their own respective rights want to merge?

"The operations of Skelly and Tidewater would put the combined company in a more competitive position," Getty said. "Skelly has greater crude-oil producing capacity than presently used by its refineries.

"Tidewater on the other hand has refinery capacity and crude requirements in excess of its crude production.

"A merger would give the combined company a better balance between crude supply and refinery crude requirements," Getty explains.

With Tidewater's existing marketing and refining facilities on both coasts, and Skelly's Mid-Continent refining and marketing operations, the combined company would pretty well blanket the country.

Much the same situation exists in the promotion activities of both companies. Tidewater's major exploration and development operations are concentrated in California, southwestern Texas and Louisiana.

On the other hand, Skelly's production is mainly in West Texas and Oklahoma. Tidewater, of course, also operates in several foreign countries.

Imports boost merger . . . Another factor no doubt contributing to Tidewater's interest in acquiring Skelly's excess production was the stiff import restrictions clamped on Tidewater right after it had completed its huge Delaware refinery. The 140,000-bbl. Delaware plant was designed and built to operate on foreign crude.

Another byproduct of Tidewater's import ailments cropped up in a San Francisco superior court June 30. California Transport Co., a Standard Oil Co. of California subsidiary, filed suit against Tidewater in a dispute over some tankers chartered by Tidewater from Cal Transport Co.

The tankers were chartered in anticipation of moving foreign crudes to Tidewater's East and West Coast refineries.

Saves Fuel, Gives Greater Thrust to Jet Engines

An educated guess, however, is that, instead of conserving fuel, the airlines will concentrate on greater payloads and longer distances. Their imperative need to get the maximum utilization out of a plane that cost them around $4,500,000 makes it almost certain that they will go for increased payload and distance in preference to fuel savings.

United Aircraft's Turbofan was the first to get substantial adoption in this country. It involves increasing the diameter of the intake fan, upping the turbine power a bit, and enlarging the housing.

American Airlines announced last week that all 50 of its Boeing 707's will be converted to or purchased with the Turbofan. American also has 25 medium-range Convair 600 jets on order. These will be equipped with General Electric's Aftfan.

United Aircraft makes these claims for its JT3C-77 engine that powers the existing Boeing 707's: It will increase the present take-off thrust of 12,000 lb. by 50%, the present climb thrust of 8,400 lb. by 27%, and reduce take-off specific fuel consumption by 13%.

Availability . . . It will be some time before these modified engines will be generally available.

United's first version, the JT3D-1, will be available in July 1960, and its already planned successor, the JT3D-3, is due in November 1961. The latter is expected to account for about a 20% greater efficiency than its predecessor, but with no greater fuel economy.

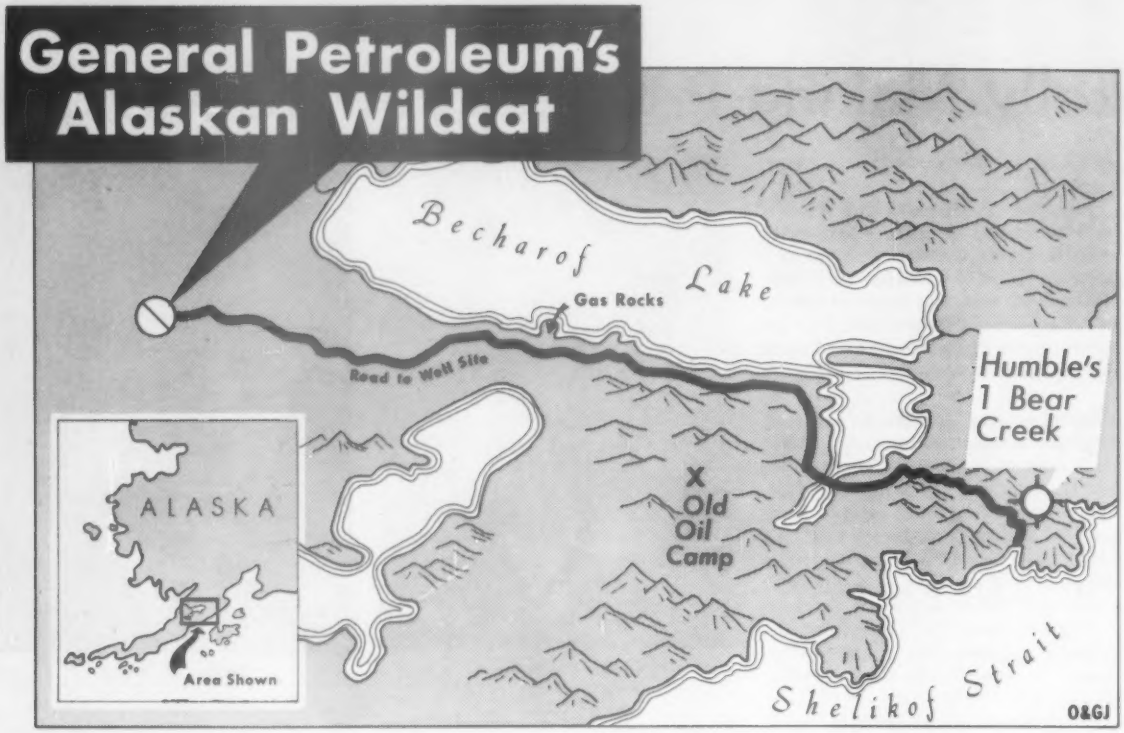
One attractive feature of the modification is that it can be made to already-built engines. It will increase the diameter of the housing to accommodate the larger fan from 39 in. to 52 in. Surprisingly, the new engine, though larger in size, will be lighter in weight. It will scale 4,025 lb. against 4,234 lb. for the engine now powering the 707.

The basic device is expected to be standard equipment on all future Boeing jets as well as the Douglas DC-8 which has yet to be delivered.

General Electric's Aftfan differs from United's Turbofan in that it's located at the rear of the engine.

The Rolls Royce Conway Bypass differs from both of the others by eliminating the fan entirely and merely allowing more air to bypass the engine and mix with the heated air that leaves the burner.

Use of this device is expected to make West-to-East nonstop Atlantic crossings possible. Most planes now taking off from New York's Idlewild airport stop either at Boston or Gander for refueling.



Another Tough Alaskan Job Started

- GP tackles Alaskan Peninsula and spuds wildcat after rugged move to Becharof Lake site. Storms and then spring thaw hamper transportation of heavy equipment during 65-mile trip.

THE LATEST in a recent series of tough drilling jobs in Alaska was spudded early last week by General Petroleum Corp. near Becharof Lake on the Alaskan Peninsula.

The General Petroleum wildcat, 1 General Petroleum - Great Basins-Becharof, is the first planned under a 455,573-acre development contract approved earlier this year by the Interior Department (OGJ, Mar. 30, p. 99).

The acreage includes 300,000 acres obtained under an option agreement between General Petroleum and the

BEING towed by a caterpillar, this 60-ton truck loaded with equipment starts rough 65-mile trip to site of GP's wildcat.

HEAVY equipment moving along shoreline of Lake Becharof with Gas Rocks jutting up in the background.

Bristol Bay group and about 155,500 acres from other companies.

The agreement with the Bristol Bay group gives General Petroleum the right to pick up more acreage during the next 10 years by additional drilling. The Bristol group gets 25% net profits of the first producer and a 25% working interest in subsequent wells.

The development contract with the Government covers the entire 455,573 acres. It will permit General Petroleum to keep development rights on 50% of the area. The company has 2 years in which to select its acreage, which is to be in a "reasonably compact" area. The contract will permit the company to exceed the usual Alaskan acreage limit of 100,000 acres of federal lands.

The contract also provides that General Petroleum must:

. . . spend $150,000 in exploration or drilling the second year. This is in addition to costs of the first well.

. . . drill a well in each of the third and fourth years of the contract.

The Bristol Bay group is composed of a number of companies and individuals headed by Great Basins Petroleum Co., Reserve Oil & Gas Co., Monterey Oil Co., Hudson Gas & Oil Corp., and Republic Natural Gas Corp. Great Basins acts as spokesman for the group.

The move . . . In terms of miles, General Petroleum's move to Becharof Lake wasn't too impressive. But in terms of hazards and hardships, it added an important new chapter to Alaska's history of rugged oil operations.

The drill site, selected after a geophysical and geological study conducted last year by the operator and Great Basins, is about 300 miles southwest of Anchorage. It's about 65 miles northwest of Humble Oil & Refining Co.'s Bear Creek Unit base of operations. (See map).

General Petroleum had one advantage not usually enjoyed by Alaskan operators. They had virtually a complete rig and camp facilities available only 65 miles from the drill site. General Petroleum merely contracted to use all of Humble's Bear Creek Unit equipment. But 65 Alaskan miles are roughly equivalent to 650 miles practically anywhere else.

Plans called for moving supplies, equipment and men to the site by truck from Humble's Bear Creek camp, by barge from Los Angeles, and by helicopter from King Salmon, north of the site.

While two barges were en route from the United States, General Petroleum planned to complete the 65-mile road from Jute Bay, near the Bear Creek Unit, to Becharof Lake.

It looked nice on paper, but as in so many other Alaskan operations, the weather man had other ideas. For instance:

. . . Just when it appeared the tundra was frozen enough to support the huge truck loads of drilling equipment, the barge convoy was forced to cover by storms.

. . . By the time the storms subsided enough for the barges to proceed to Jute Bay and unload, the spring thaw turned the 65-mile road into a treacherous trail of mud and ice.

"It was the toughest job by far I've ever had," said Ted Mathews, a 30-year veteran of Alaska roadbuilding.

A typical three-truck convoy, accompanied by two caterpillars, took 8 days to make the 65-mile trip. The convoys usually were under way by 4 a.m. daily and didn't halt until 8 p.m.

Severe weather conditions also made helicopter operations extremely difficult. Winds reached up to 155 miles per hour.

Robert D. Townsend, Jr., is General Petroleum's project engineer on the job. The well is being drilled by Rowan Drilling Co. Ft. Worth.

Hero of the operation thus far is Rowan's Red Adams. Adams volunteered to dive into the 34° water of Shelikof Strait to open a fuel line

Navy Wants Water But It Will Settle For a Dry Hole

THE U. S. Navy is looking for a drilling contractor who doesn't care whether he strikes oil or water.

All the Navy wants is someone to drill to 5,000 ft. in search for water beneath the Naval base at Guantanamo Bay, Cuba.

The Navy didn't say what would happen if the bit finds oil, but it did point out that the driller would be "paid for learning about the stratigraphy of southeastern Cuba."

Anyone interested in the job should write to the Area Public Works Office-Caribbean, U. S. Naval Station, San Juan, Puerto Rico. Capt. Kenneth C. Lovell, USN, is the officer in charge of the contract.

INSPECTING old Alaskan oil camp is R. O. Swayze, GP vice president. GP had interest in dry hole drilled here from 1923 to 1926.

ALASKA statehood was observed by these oil men at site of the new wildcat.

valve on one of the barges. He thawed out none the worse for his dunking in the waters which can kill a person within minutes.

General Petroleum didn't release any information on costs or probable well depths. But it's estimated the first well will be taken to at least 10,000 ft. As to costs, a spokesman merely said the move to the site was "extremely expensive."

Other projects . . . The General Petroleum wildcat joins a list of active drilling projects in the new 49th state. These include:

. . . Iniskin Bay. Alaska Consolidated Oil Co. was drilling below 7,100 ft. on 1 Antonio Zappa in the Iniskin Bay region west across the Cook Inlet from the Kenai Peninsula.

. . . Swanson River. On the Kenai Peninsula itself, Standard Oil Co. of California was conducting water shutoff tests on the 12,582-ft. Swanson River (formerly 4A Swanson River), and was rigging up to start drilling on 12-27 Swanson River (formerly designated 6 Swanson River). Both tests are on the Swanson River Unit.

. . . Kenai Unit. Union Oil Co. and Ohio Oil Co. were drilling ahead below 8,836 ft. on their wildcat 5 miles south of the town of Kenai on the Kenai Peninsula.

In addition, Richfield Oil Corp. has a rig en route from Bakersfield, Calif., for use on its first wildcat on the 489,622-acre Katalla-Yakataga Tract No. 1 on the Gulf coast of southern Alaska.

Leasing Changes Proposed

. . . for Alaska in compromise measure which cleared House interior committee. Hearings will be held this week on further changes in Mineral Leasing Act.

THE HOUSE interior committee has cleared a compromise bill to encourage more exploratory drilling in Alaska.

As approved by the committee, the bill would allow a company or individual to hold federal leases or options on up to 600,000 acres in the new state. Under present provisions of the Mineral Leasing Act, the limit in Alaska is 100,000 acres for federal oil and gas leases and 200,000 acres for options (see related story, p. 64).

The bill, as introduced by Rep. Ralph J. Rivers (D-Alaska), originally provided a combined lease-option limit of 1,000,000 acres. Rivers agreed to the 600,000-acre limit last week after the Interior Department had objected to the more liberal provision.

Late last month, Interior officials suggested an amendment setting the lease-option limit at 600,000 acres, but keeping individual holdings within 300,000 acres on each side of the Brooks Range in northern Alaska. Rivers objected that this would force companies with maximum holdings in southern Alaska to go to the most inaccessible part of the new state to expand their operations there.

The compromise bill would eliminate the distinction between leases and options in computing the holdings of a company or individual in Alaska. It also would omit the two-zone limitation sought by Interior officials.

Other leasing changes . . . Further changes in the leasing law will be considered this week by the Senate public lands subcommittee.

Sen. Clinton P. Anderson (D-N. M.) will preside at the July 14-15 hearings in the absence of chairman Joseph C. O'Mahoney (D-Wyo.), who suffered a stroke in late June.

O'Mahoney's so-called "ominibus" leasing bill is among the measures to be considered by the subcommittee.

The O'Mahoney bill would protect innocent federal leaseholders from cancellation proceedings based on alleged violations of the leasing act by original lessees. The Interior Department is now seeking to cancel federal leases covering more than 270,000 acres in Montana and Wyoming. Complaints charged that the leases were fraudulently acquired.

Among the other major provisions of the O'Mahoney bill is an amendment to combine the limitation of leases and options which may be held by a company or individual in any state except Alaska and Hawaii. The present limit is 46,000 acres on leases and 200,000 acres on options. The bill would set a combined total of 246,080 acres and eliminate the distinction between leases and options in computing holdings.

Lease Sale Slated

. . . by federal Government on acreage off Louisiana.

APPROXIMATELY 83,000 acres off the coast of Louisiana will be offered for lease by the federal Government August 11.

The sale will break a 4-year moratorium on the awarding of federal oil and gas leases off Louisiana's disputed shore in the Gulf of Mexico.

The 39 tracts to be offered are all in the area classified by state and federal officials as Zone 2. They are between 3 and 9 miles off the Louisiana coastline, according to Edward Woozley, director of the Interior Department's Bureau of Land Management. The tracts range in size from about 30 to 3,790 acres.

Under the federal-state agreement governing new leasing in the disputed area, Zone 2 tracts may be offered if they are deemed subject to drainage from productive leases nearby.

Minimum bonus to be accepted at the sale is $25 an acre. Proceeds will be held in escrow pending outcome of the boundary dispute, which is scheduled to be heard by the Supreme Court next fall.

The last federal leasing of outer Continental Shelf lands off Louisiana was in July 1955. A scheduled sale the following year was cancelled abruptly as a result of litigation by the state to protect its claim to the disputed area.

Only federal sale of outer Continental Shelf leases since the moratorium began was held in May. This auction involved only acreage off Florida.

Opening of bids for the August 11 auction has been scheduled for 10 a.m. in the Claiborne room, St. Charles Hotel, New Orleans.

Continental to Build Line

CONTINENTAL Pipe Line Co., a subsidiary of Continental Oil Co., will build a $2.5 million 155-mile products line and two terminals in New Mexico and Texas.

The pipeline will extend from Artesia, N. M., to El Paso. The terminals will be located at El Paso and Albuquerque. Work will start this month and be completed late this year.

The line will connect at El Paso with the Southern Pacific railroad products pipeline to Tucson and Phoenix, Ariz., and with the Standard Oil Co. of Texas pipeline to Albuquerque.

The terminal at El Paso will be

built east of the city and consist of three storage tanks with a total capacity of 77,500 bbl., an office building, and tank truck loading facilities.

The terminal at Albuquerque will be built south of the city. Its storage capacity will be 66,000 bbl.

FPC to Move Fast

. . . on proposals by Texas Gas and Texas Eastern.

THE Federal Power Commission will speed up its decision on pipeline expansions proposed by Texas Gas Transmission Corp. and Texas Eastern Transmission Corp.

The two companies are seeking authority to build or reactivate natural-gas pipeline facilities at an estimated cost of about $41,884,000.

Oral argument on related proposals by the two companies has been scheduled by the FPC for July 21. The FPC will omit the customary examiner's intermediate decision because of the urgency of the proposed projects, which are designed to meet the needs of expanding markets in the 1959-60 heating season.

What is planned . . . Texas Gas is seeking authority to construct approximately 164 miles of 30-in. loop line, about 80 miles of 26-in. loops, and 103 miles of supply lines. New facilities, to be built in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, Indiana, and Ohio, also would provide 14,000 hp. in additional compressor capacity, a new 1,760-hp. compressor station, and a 26-in. river crossing. Cost of the Texas Gas project is estimated at $39,600,000.

The facilities would enable Texas Gas to gather and transport up to 100,000,000 cu. ft. of natural gas daily, on a firm basis, for Hope Natural Gas Co. The gas would be purchased or produced by Hope from fields in and offshore from Louisiana. It would be delivered by Texas Gas to the Texas Eastern system near Lebanon, Ohio.

Texas Eastern is seeking authority to place in service about 189 miles of existing 20-in. pipeline between Middletown, Ohio, and Moundsville, W. Va., to handle the gas. The company also plans to put in service 12,500 hp. in existing compressor capacity and to add about 3,100 hp. capacity at existing stations.

Cost of the reactivation and construction by Texas Eastern is estimated at about $2,284,000.

The new gas supply would be delivered to Hope or its affiliates in Consolidated Natural Gas System.

watching WASHINGTON

Joe Reilly

• New record for pipeline approval?

TRANSWESTERN Pipeline Co. has had unusually smooth sailing in quest of a certificate to provide a new gas supply for southern California.

So far, the fledgling company has avoided most of the pitfalls that often have delayed other pipeline projects. If its luck holds out, Transwestern should have dirt flying soon along its Texas-to-California pipeline route.

Already approved by a Federal Power Commission examiner, the Transwestern proposal is to be heard by the full commission July 23. And the FPC is expected to hand down a quick decision on the $191,700,000 project.

Barring an adverse ruling by the FPC and other obstacles, Transwestern's transition from idea to operating reality would cover an unusually short period of time. Its speed already is impressive when compared with the snail's pace set by other new pipeline companies.

THE NEW LINE from Texas to previously gasless markets in Florida offers striking evidence of the normal frustrations and delays which confront new pipeline ventures. It took Houston Texas Gas & Oil Corp. and Coastal Transmission Corp. approximately 5 years to convert their pipe dream into reality.

Houston filed its application with the FPC in 1955, and Coastal followed a little later. The project had been in the planning and negotiating stage as far back as 1953.

Many frustrating months followed as the companies sought FPC approval. In December 1956 staff counsel for the FPC urged disapproval of the project. It was more than a year later when the FPC, by a split decision, granted a conditional certificate.

Terms laid down by the commission required major changes in tariff schedules. These put the proposed project back in the negotiating stage. After the changes were approved, the project was again held up for months by litigation and financing. Construction of the main line started late last summer. By then the original plans—if there were any that hadn't been discarded—must have been turning yellow along the edges.

Another newcomer, Midwestern Gas Transmission Co., had similar trouble getting approval for its proposed pipeline to the Chicago area.

The company filed application with the FPC in 1955. Its announced hope was to have its line in service late in 1956. The line isn't built yet.

Midwestern's plan lingered before the FPC 3 years. At least two versions were rejected by the commission. The project, as approved in May, represents only part of its original proposal. And the certificate had several conditions attached, reducing the company's rate of return and controlling its dividend payments.

Transwestern Pipeline Co., now possibly on the verge of success, is barely 2 years old. It was founded by Warren Petroleum Corp., Tulsa; J. B. Butler & Associates, Houston; and Monterey Oil Co., Los Angeles.

LIKE MIDWESTERN before it, the company had its eye on a highly competitive market. Like Coastal and Houston, it had strong producing interests behind it.

The new company challenged the old and aggressive El Paso Natural Gas Co. for both markets and reserves. The prices which it bid for gas brought the almost inevitable opposition of the FPC staff.

In approving the project earlier this month, FPC Examiner Harry W. Frazee overruled the price objections and applauded the company's success in acquiring gas reserves. He suggested that one relatively minor condition be attached to the certificate. It would prohibit the payment of dividends until the company has a chance to reduce its debt ratio.

If the FPC goes along with the examiner, Transwestern is almost in business.

PHOTOS IN THE NEWS

Work Enters Playland

Roller Coaster riders at Long Beach's fun zone get a close, though fleeting, look at the latest in soundproof drilling operations as they whiz by. Richfield Oil Corp. is using this rig to drill water-injection wells into Fault Block VI as part of the gigantic million-barrel-daily project to halt subsidence in Wilmington field. This drill site is the first to be located on the south side of the main flood-control channel which separates Wilmington field from downtown Long Beach.

Odd Job for an Oil Man

Daniel J. McHugh's unusual occupation is that of dishwasher for Esso Research & Engineering Co. Purpose of the scientific KP is to help develop better synthetic detergents from petroleum.

Immediate objective of McHugh's efforts is to determine the foam stability of new soaps being tested. Or, in simpler terms, how long the suds last. Esso knows that foam doesn't accurately measure the efficiency of a detergent. But it also knows that housewives still tend to rate cleansers by the amount of suds they produce.

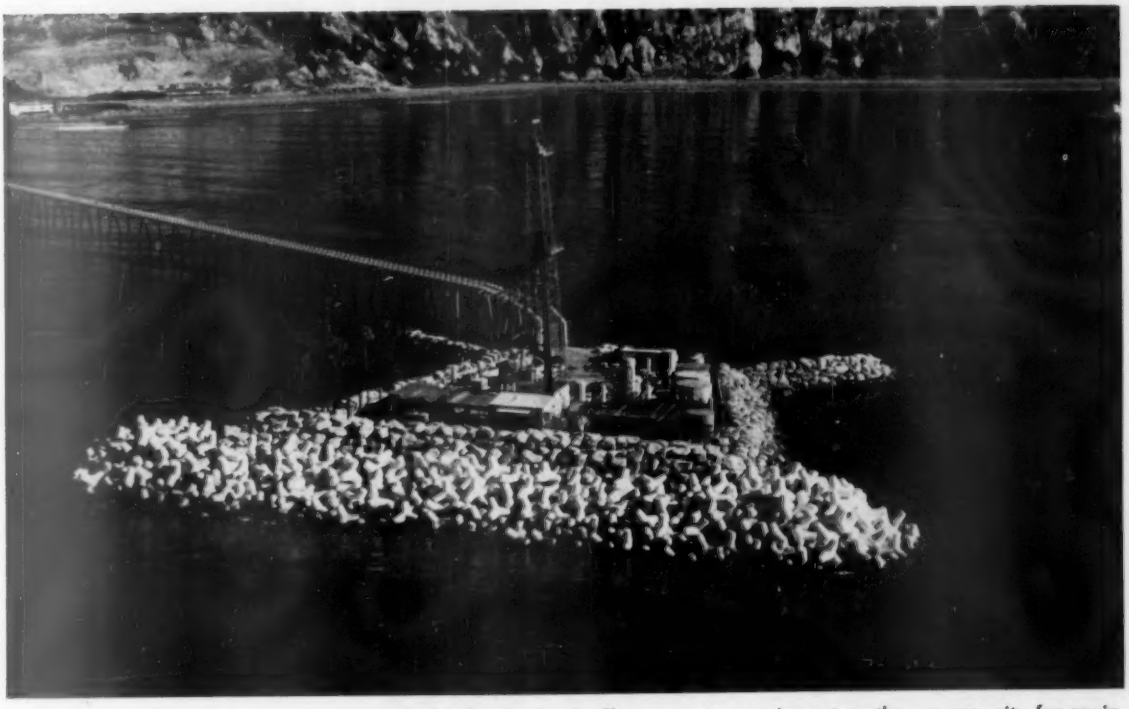
So, McHugh keeps on washing dishes. Esso admits it could use a scientific apparatus to measure foam stability. But, it says, actual dish-washing is the best test.

Unequal Task

If these twin pumping units were human, you'd suspect the left one had been sick. But since its job is easier, Shell Oil Co. picked a smaller unit.

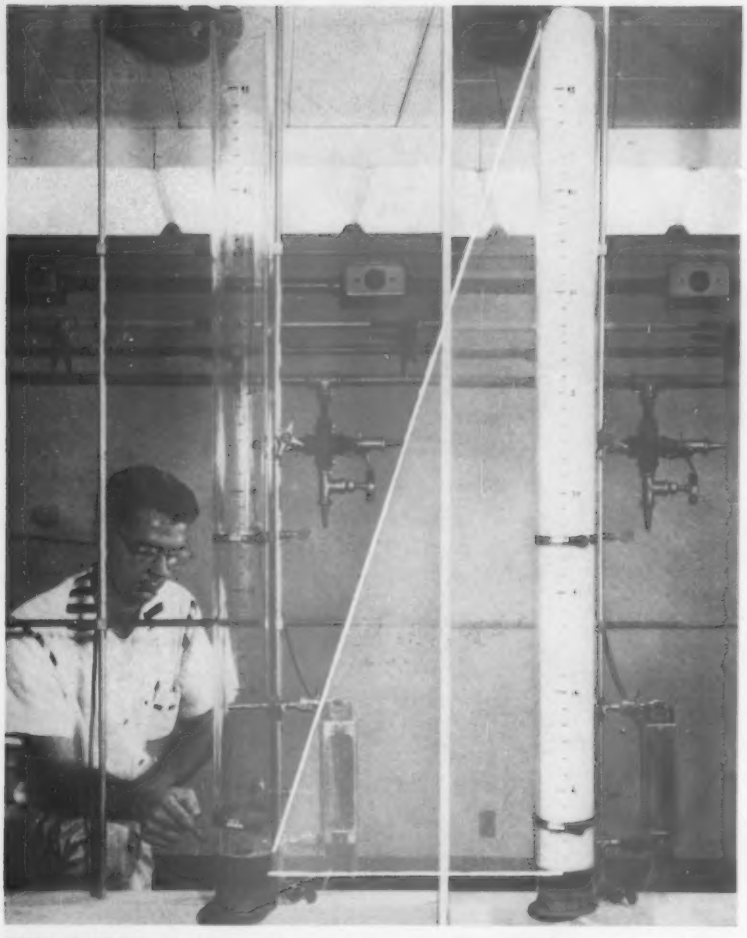
These pumpers produce a Shell dual completion in Quitman field of Wood County, East Texas. The small unit pumps from the Eagle Ford; the larger produces the Woodbine. The Woodbine produces about three times the crude as does the Eagle Ford. Hence the difference in size.

The well was completed with parallel strings of tubing.



Beauty Spot Is Busy

This palm-bordered island offers a textbook study in compact drilling and producing operations. Richfield Oil Corp. is getting ready to spud its fifth well since it built the island off Ventura County, California, last year. It now has all the equipment on the one-acre site for equipping 68 wells, including tanks, separators, and pumping facilities. Richfield is using the earth-filled island, located in 45 ft. of water half a mile from shore, to develop a 1,175-acre lease.



SMALL AMOUNT of chemical in tube at left can be expanded more than 50 times its original volume (right). John Rodgers of Dowell's research lab shows how the foam can fill every nook of a vessel being cleaned.

Chemical Foam Developed

. . . by Dowell scientists solves many tough problems faced in cleaning complex industrial equipment.

A NEW method of making a chemical lather that may revolutionize the cleaning of industrial equipment has been developed by research chemists for the Dowell Division of the Dow Chemical Co. in Tulsa.

Secret of the new method is an unusual apparatus for making the chemical lather or foam and a new industrial-foam solvent.

The apparatus was put on display by the Dowell Division of the Dow chemical research lab. It works like this:

The foam solvent is pumped from the apparatus directly into the tank, pipe, or tower to be cleaned. After the vessel is filled, the chemical foam overflows into a foam breaker, and a filter removes the material dislodged by movement of the foam through the equipment. The solvent is then recycled through the foam generator and the unit being cleaned. Routine tests tell when the job is finished.

Meets many problems . . . Dowell engineers are enthusiastic over the potential of the new technique.

They say it is now possible to:

. . . **Use solvents** to clean large-volume systems with a small amount of liquid. The ratio of foam to solvent will average 20 to 1 and can be as high as 50 to 1.

. . . **Chemically clean** towers, pipe assemblies, and other equipment that would not stand the weight and hydrostatic pressure caused by liquids.

. . . **Use concentrated** chemical solvents where needed. Previously, cost of concentrated liquid solvent often was prohibitive.

. . . **Remove readily** any sloughed materials because of the excellent particle-carrying property of the foam.

Other advantages: Waste-disposal problems are reduced because of smaller quantity of solvent used. Transportation costs likewise are lower. The foam-generating equipment also is lightweight and can be moved on a small truck.

The foam solvent for nearly every type of deposit can be tailor-made for any complex equipment. It will fill completely every loop and bend, every nook and cranny.

It also is possible to reduce after-rusting problems because the cleaned metal surfaces are not exposed to air during the cleaning process. The foam solvent is displaced directly with a foam rinse or flush followed by a foam passivator.

Supplier Drops Rigs

. . . in favor of expanding other phases of business.

BETHLEHEM Steel Co., Supply Division, is quitting the manufacture of drilling equipment at its Corsicana, Tex., plant but intends to expand its activities in every other phase of the oil-field supply business.

This policy action by one of the famous names in drilling equipment was revealed last week by Vice President C. R. Zimmerman.

At the same time he announced that arrangements have been completed with Continental-Emsco Co. to handle spare parts and service for all existing Bethlehem drilling equipment.

Zimmerman said that the Supply Division will expand its Tulsa manufacturing operations on its line of pumping units and utility pumps. The utility-pump line will be moved from Corsicana when the plant there is shut down.

Zimmerman had a simple explanation for the move: The company was just not making money manufacturing drilling equipment. He said the capacity of the industry to produce drilling rigs has exceeded the demand for several years. The upshot was that the Corsicana operation was not profitable.

Zimmerman said the company is now mapping aggressive sales plans for its line of pumps and other oil-field supplies adding: "We're in the oil-field supply business stronger than ever except for manufacture of drilling machinery."

Gasoline-Tax Increase Looms

. . . as Democratic leaders in Congress soften opposition.

It looks like a compromise of ½ or 1-cent-a-gallon hike.

OPPOSITION to an increase in the federal gasoline tax appears to be withering amidst growing speculation of a compromise plan to provide extra money for the big highway-building program.

Trial balloons sent up from the capitol and the White House point the way toward a possible face-saving solution to the highway-financing problem.

President Eisenhower has indicated to Republican congressional leaders that he would relax his demands for a temporary tax increase of 1.5 cents per gallon. He is understood to be aiming now for a hike of only 0.5 or 1 cent per gallon.

The word from the White House came in response to feelers put out several days earlier by Democratic leaders in Congress.

House Speaker Sam Rayburn (D-Tex.) personally directed much of the long-range negotiating with the White House. After turning thumbs down on the President's proposal for a tax hike of 1.5 cents, Rayburn told reporters that Congress might consider a smaller increase.

Wilbur D. Mills (D-Ark.), chairman of the House ways and means committee, may act soon on the compromise plan.

A 1-cent tax hike would bring in about $482,000,000 this year. That would be almost enough to offset the anticipated deficit of $500,000,000 in the highway trust fund under the current tax program. The administration apparently is ready to accept "two-thirds of a loaf" provided the pay-as-you-go provision of the highway program is suspended. That would permit road-building to continue on schedule.

If Eisenhower gets only one-third of the tax increase originally sought, he is expected to insist on extension of the highway program 2 years beyond its present 1972 expiration date.

Rayburn, Mills, and most other influential Democrats in the House still oppose any tax increase on gasoline. The same is true of Senate leaders, although Chairman Harry F. Byrd (D-Va.) of the Senate finance committee is more strongly opposed to deficit financing than he is to a tax hike.

The Senate several weeks ago voted 46 to 33 against a 1.5-cent increase. At least 12 other senators were on record against the tax hike. But that still leaves the Senate short of the two-thirds vote needed to override the anticipated veto of a highway plan based on deficit financing.

If congressional Democrats go along with a temporary tax increase, they may be able to earmark for the Highway Trust Fund part of the highway-user taxes now going into the general fund for nonhighway purposes. In the past, though, Eisenhower has indicated any such plan would be vetoed.

While congressional leaders seemed ready to accept a compromise, oil spokesmen and many highway-user organizations maintained stiff opposition to any tax increase on gasoline.

Their best bet to avoid a tax hike appeared to be a plan by Sen. Francis Case (R-S. D.). He has introduced a resolution which would authorize the Secretary of the Treasury to issue interim bonds to keep the interstate highway program on schedule. The bonds, together with interest, would be paid off from future trust-fund collections.

Sooners Pass Spacing Bill

THE OKLAHOMA legislature passed one major oil measure and let another one die before ringing down the curtain on the longest session in state history.

Awaiting the governor's signature to become law is a bill allowing 80-acre spacing for oil wells of medium depth—5,000 to 10,000 ft. The bill gives the Corporation Commission authority to grant the 80-acre spacing, twice the spacing now permitted for oil wells. Maximum spacing for gas wells will remain at 40 acres.

The measure which was permitted to die would have raised Oklahoma's percentage depletion from the present 20% to 27½%—the percentage allowed by the federal Government.

the JOURNAL *said . . .*

50 years ago

July 20, 1909

Crude oil is finding a new use in parts of Southwest and West Texas where cactus abounds. With it as fuel in specially designed burners, cattlemen burn the spines off cactus. Cactus, with spines removed, can be eaten and is an excellent feed and a good source of water for livestock.

Scarcity of water for boilers is forcing the shutdown of most of the 10 drilling rigs which have been operating in the Madill area, Marshall County, southern Oklahoma.

The cargo-laden steamship, Alaskan, replacing coal with oil for fuel, completes record run from Hawaiian Islands to Philadelphia, via Straits of Magellan, in 63 days. It burned 15,000 bbl. of oil. No stops for fueling were needed. Use of oil made it possible to dispense with the service of 10 firemen.

Humble leads all Gulf Coast fields in activity with 23 new wells completed during the week.

25 years ago

July 12, 1934

Gulf Oil Corp. and Anglo-Persian Oil Co. join in organizing Kuwait Oil Co. for petroleum exploration and exploitation of Kuwait.

Naval Reserve pool crowds out old Burbank as top producing area in Oklahoma's busy Osage County. Daily output of Naval Reserve climbs above 9,500 bbl., passing Burbank with 9,250 bbl. daily.

Standard Vacuum Oil Co. completes plans for $3,000,000 pipeline and refinery expansion project in Sumatra.

Completion of two oil gushers turns industry's eyes on Hobbs field, N. M. Gypsy Oil Co.'s 8 West Grimes flows 17,625 bbl. daily. Shell Oil Co.'s 2-B State is second with 10,400 bbl. daily.

HEADLINES: Labor troubles in East Texas and California slow drilling and refinery distribution operations. . . . Refinery modernization and building projects under way in Pennsylvania Grade area represent $3,500,000 investment.

10 years ago

July 14, 1949

Texas congressmen, after hearing complaints of independent oil producers, organize to seek reduction in imports.

Basin and Ozark Pipe Line systems, with largest crude-oil line ever built with private capital in America, formally opened at dedication ceremonies at Cushing, Okla. Newly completed lines stretch 1,000 miles from Jal, N. M., via Cushing, to Wood River and Patoka, Ill.

First shipments of gas chemicals leave McCarthy Chemical Co.'s huge new plant at Winnie, near Beaumont, Tex.

Northern Pakistan draws attention as Burmah Oil Co. brings in 112-bbl. oil well in major stepout for Chakwal area and company's first success in new exploration program.

HEADLINES: Brazil seeks Czechoslovakian equipment for proposed refineries. . . . Lion Oil Co. spends $6,300,000 on expansion of chemical plant at El Dorado, Ark.

Radioactive Wastes May Become Future

- TPRC is opening new roads to hydrocarbon recovery through studies of atomic wastes. Early research indicates an exhausted gas pool may be converted to a profitable condensate field by injecting wastes.

Robert J. Enright
Dallas District Editor

INTENSIVE RESEARCH with radioactive wastes indicates it may be possible to use these substances to hike recovery from hydrocarbon reservoirs.

A specific instance: It now appears likely that an operator will be able to inject fluid radioactive wastes into an abandoned gas reservoir, seal it up and forget about it for 30 years, then reopen it as a commercial condensate field.

This is tentatively predicted by Dr. George Crawford, who has directed exhaustive research work on the subject at the University of Texas for the Texas Petroleum Research Committee for the past year.

TPRC took on the project in cooperation with the Atomic Energy Commission.

It started the project with AEC assurance that liquid radioactive wastes, through dilution with water, can be injected into a reservoir with conventional equipment and with no danger of exposing personnel to excessive, harmful radiation.

Liquid wastes would be used because solids couldn't be injected and gases would be too dangerous.

Starting from this, TPRC has concerned itself with what happens to the hydrocarbons when they are exposed to gamma radiation.

What it found . . . It already has made significant findings, though the research work is considered still in an early stage.

For its experiments, TPRC is using Cobalt 60 as its source of gamma rays. The radioactive material belongs to the radiobiological laboratory of the University of Texas. And the experimental exposures are carried out at Balcones Research Center on the university campus.

This particular material is used because it has a half life of the desired longevity—about 30 years. Gamma radiation also is used because gamma rays alone will penetrate far enough into reservoir rock to be effective.

TPRC started with the simplest hydrocarbon and the prime component of natural gas—methane.

Pure methane in a container was exposed to radiation for a 3-week period. The resulting products were identified and the amount of each calculated carefully through use of mass spectroscopy and gas chromatography.

This, Dr. Crawford tells the Journal, is the first time that both methods have been used to analyze gas composition changes due to radiation.

The methane, TPRC found, was converted into both gases and liquids.

Of the resulting gaseous products:

. . . 75% was hydrogen.
. . . 14.2% ethane.
. . . 6.7% propane.
. . . 2.4% ethylene.
. . . About 1% butane.

Perhaps even more important, however, was the discovery that roughly

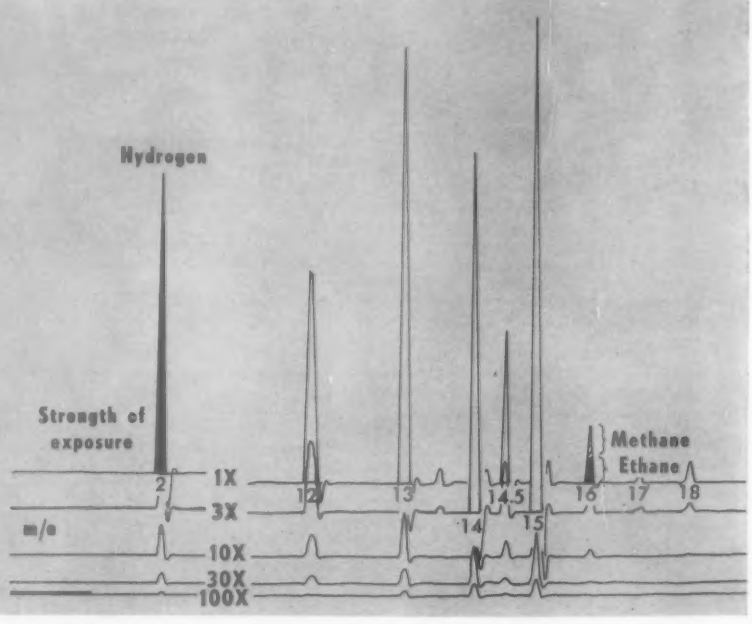
How gamma radiation affects pure ethane

Principal products produced when pure ethane is exposed to Cobalt 60 are hydrogen, methane, propane, and normal butane. Parent peaks of each gas are highlighted on this mass spectrograph.

Each peak has five different traces, each with a different sensitivity. The parent peak of ethane also is shown. This is unconverted ethane that shows up strong when the strength of the exposure is increased to 10 times the original exposure.

Experiments conducted by TPRC shows 17% of the ethane exposed to Cobalt 60 is converted to liquid. Similar experiments have been conducted with methane, propane, and mixtures of the two with ethane.

This mass spec of ethane resulted when the ethane was exposed to a total dose of 3.5 by 10^7 roentgens.



during the week.

area represent $3,500,000 investment.

Dorado, Ark.

Oil-Recovery Tool

24% of the methane was converted into liquids which apparently polymerized on the walls of the container. These liquids have not been firmly identified. But, Crawford says, TPRC has been able to ascertain that they are heavy, unsaturated hydrocarbons containing two parts hydrogen to each part carbon.

They are not soluble in the gas phase and, he says, could be long-chain polymers. TPRC now is working to make firm identification.

Following the methane phase, Crawford and assistants successively exposed pure ethane, then propane, then mixtures of all three.

They found that the amount of the liquids and of free hydrogen fell off as the weight of the gas molecule increased. With ethane the gaseous products were: 64% hydrogen, 6.9% methane, 10.6% propane, 16.6% normal butane, 1% butenes, plus traces of others. The liquids formed fell off to 17% of total ethane exposed.

With propane, the gaseous products were: Only 39.5% hydrogen, 10.7% methane, 12.1% ethane, 5.1% isobutane, 1.7% normal butane, 2.2% isopentane, 1.2% normal pentane, and 27.6% C_6 pluses. Four different compounds in the latter class were identified, all in the gas phase. Most numerous were the 2,3-dimethyls.

The liquids which formed represented only 6% of the total propane exposed.

Another interesting finding was made with exposure of propane. Crawford found that hydrogen atoms freed from propane molecule always came off the center carbon atom.

TPRC found that it made no difference whether exposure of the pure hydrocarbon gases to radiation was constant or intermittent—the products were the same.

What it means to industry . . . These analyses indicate to Crawford that it may indeed be possible to convert an abandoned gas reservoir into a commercially producing condensate field.

The TPRC scientist has in mind a gas reservoir where pressure has dropped too low for a producer to economically deliver the gas to a pipeline.

Here's how injection of radioactive gamma ray-emitting waste might do the trick. First, the reservoir would have to be sealed, with all old wells properly plugged.

Waste-bearing water would be injected near the bottom of the pay zone. Gamma rays, Crawford says, will penetrate about 18 in. into the reservoir rock on the average. In this distance about 90% of the rays would be absorbed. The entire reservoir would be affected, however, in that the reaction at the bottom of the formation would create a mixing and circulating effect all through the pay.

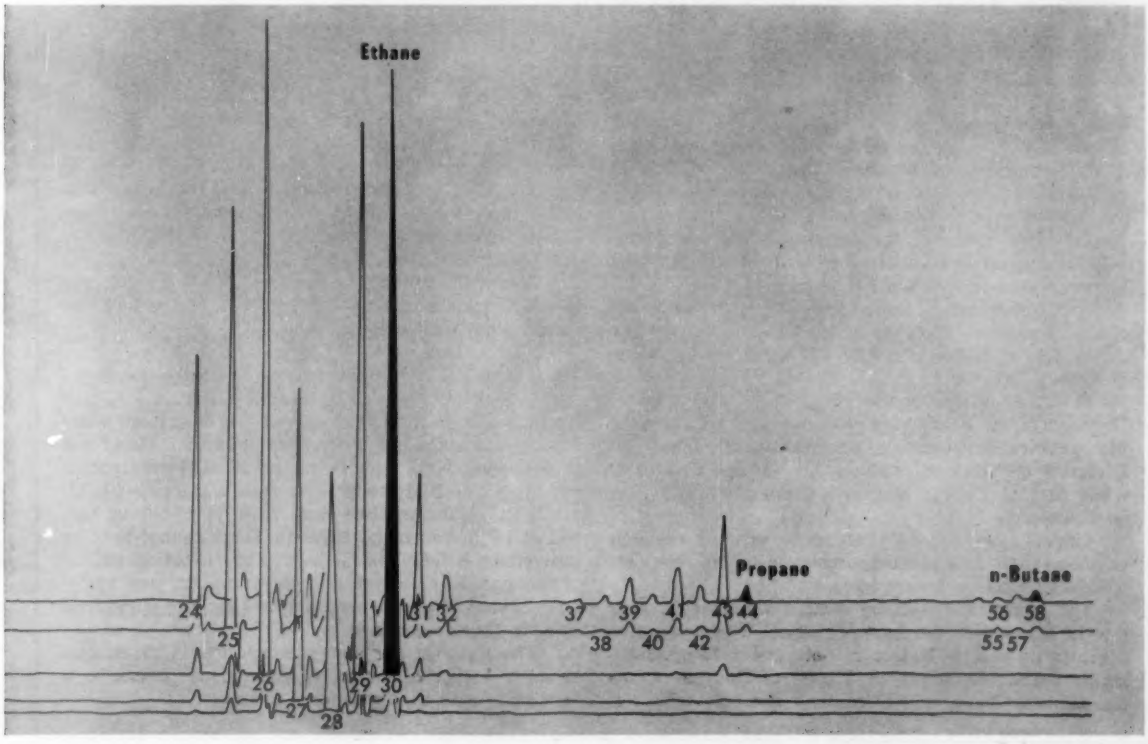
Hydrogen gas, freed by the reaction from the natural gas in the pool, would move to the highest portion of the reservoir and displace more natural gas downward into the reaction zone.

This circulating effect would be complemented in that the heat of the reaction would vaporize the water used as the carrying fluid. The steam would move up through the reservoir, condense as it encountered increasingly cooler pay, and trickle back down as water to be vaporized again.

A plastic layer? . . . There is a possibility, Crawford says, that the first liquids formed might be converted by the heat of the reaction into a plastic-like layer just above the radioactive source.

This, he thinks, might even prove an aid to the project if it were to occur. The impermeable layer would not prevent gamma rays from penetrating on up into the reservoir. But it would block the condensate being formed there from moving down into the most radioactive zone.

After 30 years, most of the gas in



the pool would have been changed into condensate due to this steady, boiling activity.

Furthermore, the condensate formed would no longer be radioactive.

What's still to come? . . . TPRC is by no means finished with this project. It has just scratched the surface.

The research, so far, has dealt only with the simpler hydrocarbons, and these in a container. TPRC now is running experiments to see if it gets the same results when it exposes to radiation these simple hydrocarbons (a mixture of methane and ethane) in their natural state in a sandstone or limestone formation.

Next it will progress to the more complicated hydrocarbons of increasingly heavy molecular weight.

It has already carried out some runs on butane and "come up with all kinds of hydrocarbon mixtures." TPRC, however, is not yet satisfied with the results.

It will keep running the butane exposures until it is satisfied. Then it will progress to pentane and on up through the heavier hydrocarbons until it is eventually working with condensate and finally crude oils.

What the TPRC researchers will come up with is anyone's guess. But the findings may prove startling and useful.

TPRC: Organized to Coax More Oil from Texas' Soil

THE Texas Petroleum Research Committee was set up in 1947 by joint resolution of the Board of Regents of the University of Texas, the Board of Directors of Texas A. & M., and the Texas Railroad Commission.

It brought together the research facilities of the two schools and the tremendous store of data and field experience of the commission. The aim: To cooperatively seek, with TPRC as the vehicle, means to increase total recovery of oil and gas from Texas fields. In the process, TPRC also would serve to improve the training of the skilled scientists and technologists so badly needed by the industry.

The committee has been highly successful in carrying out both purposes.

It has contributed importantly to the technology of drilling fluids, salt-water disposal, well stimulation, reservoir engineering, secondary recovery, and toward solving heaving shale and other difficult drilling problems.

At the same time, it has enabled more than 200 young men to stay in school and receive added training prior to launching their careers with the industry. These students have contributed important data and work reflected in an impressive list of over 50 publications available to the industry.

How it is organized . . . The committee is composed of two professors of petroleum engineering from each of the two schools under the chairmanship of William J. Murray, Jr., member of the Railroad Commission—and himself a petroleum engineer.

Murray is joined on the committee by Profs. Frank W. Jessen and Sylvain J. Pirson of Texas U. and Harvey Kennedy and R. L. Whiting of Texas A. & M.

The committee is responsible for determining the technical research program which shall be carried out at the two divisions of TPRC at Austin and College Station.

In actual charge of carrying out this program is Dr. George H. Fancher, TPRC director and head of the petroleum-engineering department at Texas U. Directing the work at Austin is Dr. George Crawford, while that at College Station is headed by Dr. Paul B. Crawford.

Under them currently are nine salaried research engineers and four undergraduate engineers—the latter working on an hourly basis.

The number of working engineers fluctuates, with the TPRC budget the limiting factor. The committee operates on a state budget of only about $60,000 annually. And all but about $5,000 of this has to go for salaries. Thus, TPRC couldn't compete with private industry research labs even if it wished. As Dr. George Crawford puts it, "All we have is brains . . . so we confine our work to basic research with little risk that we are duplicating work by commercial or oil-company research labs.

Dr. George H. Fancher
. . . the man who directs TPRC operations.

"The fruit of this basic research is made available to the industry. And the industry, where it can, reciprocates by complying with TPRC requests for information, cores, etc."

Along with the research work, TPRC each year sponsors an oil-recovery conference on a problem of special significance to the industry.

Much at stake . . . TPRC's motives, of course, aren't entirely unselfish.

Both Texas U. and Texas A. & M. have large interests in widespread, valuable oil holdings. These aid in endowing both schools via royalties, lease rentals, and large bonus payments when lease auctions are held.

TPRC estimates that more than 15½ billion barrels of oil in known oil fields in Texas cannot now be recovered. It feels that at least 6 to 10 billion barrels of this could be recovered in the future by new methods adapted to Texas conditions. This, the committee says, is "buried treasure."

"The stake in our state's prosperity, in taxes, and in aid to higher education, is tremendous. It can be a very real factor in our national security."

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. . . that a zone, or a section of casing is positively isolated, set a . . .

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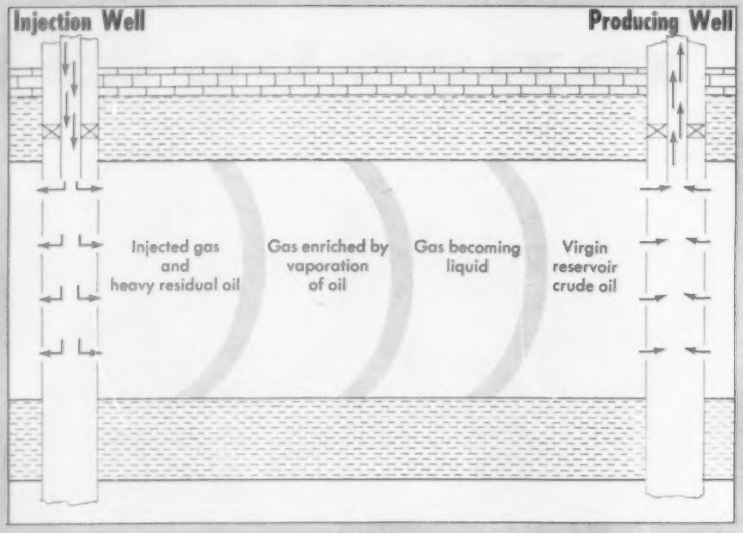
How Atlantic's High-Pressure Injection Works

Dry gas under high pressure is injected into the producing formation under the highly successful miscible-displacement method used by Atlantic Refining.

Under this high pressure, the dry gas is miscible with the lighter components in the reservoir crude. It picks up these components as it moves toward producing wells.

The gas achieves a high degree of solubility in the virgin reservoir oil. And, as it moves forward, it creates and pushes ahead a bank of swollen liquid. The bank of liquid forces virgin reservoir to producing wells.

As more dry gas is pumped into the pay zone, it picks up intermediates until only a relatively small volume of heavy residual oil is left behind.



OGJ

Atlantic's Recovery Method Licensed

● Dallas engineering company will handle the high-pressure gas-injection method which has worked so well in two fields for Atlantic.

THE ONLY miscible-displacement method so far to prove itself highly successful in the field as an economic means of hiking oil recovery is now available to the oil industry generally.

This is Atlantic Refining Co.'s patented high-pressure gas-injection process. The technique already has enjoyed spectacular success in two reservoirs—University Block 31 Devonian in Crane County, West Texas, and Neale field in Beauregard Parish, Louisiana.

Atlantic last week announced the selection of James A. Lewis Engineering, Inc., a Dallas petroleum-engineering consultant, as agent to license the process for use by other oil companies.

The action, Atlantic said, "opens the door to the great store of both laboratory and field data Atlantic has accumulated after more than a decade of experience with its high-pressure gas process."

Many candidates . . . Atlantic technicians estimate the high-pressure gas process is applicable to 5% of domestic reserves.

On top of this, they feel that still more reserves will be recovered with the method from pools which have large volumes of oil remaining after water drives have exhausted their capabilities.

Whether a pool is an acceptable candidate for the Atlantic process depends primarily on its reservoir pressure and oil composition.

Generally, it works best in undersaturated reservoirs with bottom-hole pressures in excess of 3,000 psi. The exact pressure varies somewhat with temperature and gas-oil ratio of a reservoir but more according to the amount of intermediates (LPG) in the oil.

A reservoir containing light crude is much preferred, Atlantic says, over one containing heavier oil. Particularly attractive for the process are oils over 40° gravity.

Atlantic feels the high-pressure process will find steadily widening application in future years as deeper and deeper drilling continues to bring in a larger share of high-pressure fields.

The high-pressure process normally will not sweep as much reservoir space as water, but it will recover much more oil from the area swept. Also attractive is the fact that the high-pressure gas method is cheaper to get under way since fewer input wells are needed.

The Atlantic method is the only miscible drive of the several now in the field which does not require injection of either LPG or of a gas enriched with these hydrocarbons.

Atlantic injects dry gas. It achieves miscibility by manufacturing the intermediates in the reservoir.

Block 31 bonanza . . . Atlantic has been injecting gas into the middle Devonian zone in Block 31 field for 10 years. It has carried out full-scale pressure maintenance operations there for the past 6½ years.

During this time, the field has produced more than 40,000,000 bbl. of

oil. This is almost as much as the total recovery expected from the field if the process had not been applied.

Block 31 is still producing at a top allowable of 15,000 bbl. per calendar day—more than twice the daily production prior to start of the program.

And Atlantic estimates that ultimately it will recover more than 150,000,000 bbl. from this prolific field. Most of this total, it says, is attributable to the high-pressure gas project.

Atlantic is injecting about 42,000,000 cu. ft. of gas daily at a bottomhole input pressure of roughly 5,000 psi. It is increasing the size of its injection plant to about 10,600 hp. from the present 9,500 hp.

It has injected a staggering total volume of about 95½ billion cubic feet of gas.

Despite such huge injection at such high pressure, there has been no adverse breakthrough or channeling. The two producing wells closest to input wells are just now beginning to produce some gas. This long delay in appearance of the gas indicates almost complete removal of the oil from the area swept.

The breakthrough finally into the nearest producers came very close to the time predicted by Atlantic when the program was kicked off.

Gas-oil ratios of producers throughout the field remain at their initial values, except for these closest offset wells.

Neale doing well, too . . . Atlantic has had great success also with its smaller project in Neale field in Louisiana.

This one, started about 3 years ago (OGJ, Dec. 19, 1955), is being carried out in Neale's 10,400-ft. sand.

So far, oil recovery there has reached about 25% of that originally in place and production rates remain high.

Recovery, in fact, has already passed the total volume expected via primary production alone.

Atlantic predicts that it eventually will exceed 60% of initial in-place oil at Neale.

Water Rights Getting Scarce

WATER-FLOODING projects in southeastern New Mexico have brought a rush by oil companies and speculators to tie up remaining unappropriated water rights in the Lea County Underground Basin.

Land Commissioner Murray Morgan said applications are now pending in his office for leases covering some 30,000 acre feet of water per year for oil-recovery purposes alone. A large number of them were filed by individuals who intend resale to oil companies with flooding projects. Water from the Lea County basin is being piped into Eddy and Chavez counties because all water in both the Carlsbad and Roswell Artesian basins has long since been appropriated.

Reynolds said that about 80 per cent of the Lea County Basin has also been appropriated—leaving only about 90,000 acre feet per year available for water-flooding projects.

Agreement Reached

. . . for cooperative flood in two Wilmington blocks.

ANOTHER major step towards a proposed 1,000,000-bbl.-daily flood in Wilmington field was taken last week when operators in Fault Blocks II and III agreed on terms of cooperative flooding agreements.

The agreements, which cover the upper four zones in both blocks, are an interim measure until actual unitization is completed.

The areas involved include those adjoining or underlying the Long Beach naval shipyard, the area of the most critical subsidence. Terms of the pacts call for injection rates into the two blocks to be stepped up from a present 23,000 bbl. daily to as much as 273,000 bbl. daily by the end of the year.

Of these amounts, 173,000 bbl. will go into Long Beach-owned tideland portions of the field and the balance into privately operated onshore areas. Long Beach will provide all the water.

Companies participating in the Fault Block II agreement will include General Petroleum Corp., Southern California Edison Co., Union Pacific Railroad Co., and the city of Long Beach. Except for General Petroleum, the same parties are involved in the Fault Block III agreement.

A Long Beach city spokesman said that operators in the two blocks are very near final unitization—just a few points yet to be ironed out.

INDUSTRY BRIEFS . . .

Two major buyers in the Denver-Julesburg basin area of Colorado and Nebraska have cut purchases about 7,000 bbl. daily or 11%, to hold stocks down. Pure Oil Co. cut 3,500 bbl. from its estimated 40,000 bbl. daily purchases, effective July 1. Sinclair Crude Oil Co., buying about 22,000 bbl. daily, earlier had reduced purchases between 3,000 and 4,000 bbl. daily.

Vista Petroleum of Denver has made an agreement to purchase controlling interest in two oil industry supply firms, Enardo Manufacturing Co. and Empire Foundry Co., Tulsa. Purchase price was not disclosed. Vista recently acquired assets of Robison Parks Controls, Inc., distributor of oil-field valves.

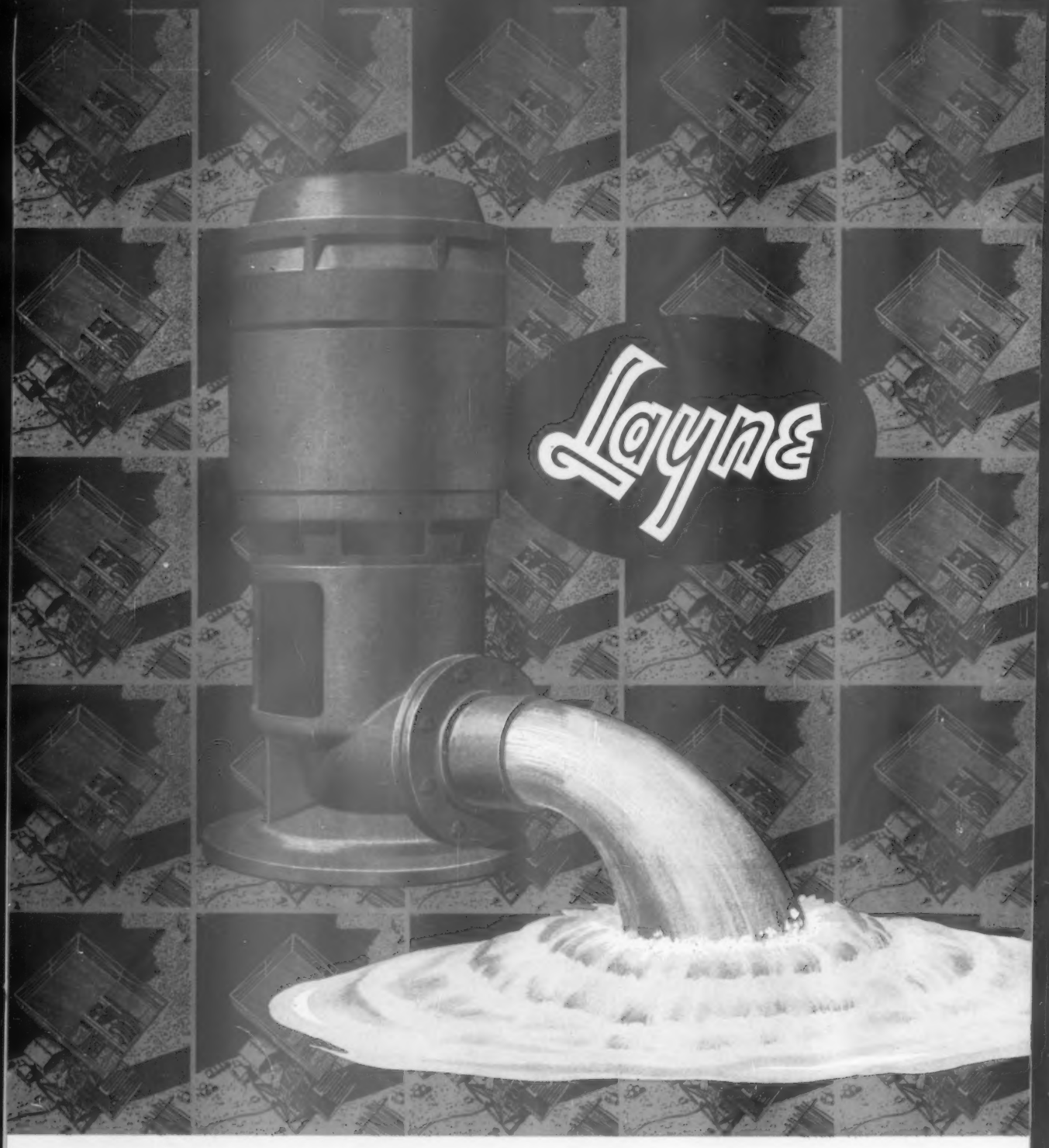
Copies of the 280 technical papers presented at the Fifth World Petroleum Congress still are available—but the stocks are being depleted rapidly. The general secretary of the congress has filled more than 150,000 orders for copies. The congress address is 527 Madison Avenue, New York 22.

Sec. of the Interior Fred A. Seaton has made a second exception to the filing deadline for oil importers. He approved a residual-fuel-oil quota of 12 bbl. a day for Copeland Terminals, Plattsburg, N. Y. The company failed to file its application within the prescribed time. Seaton earlier had intervened to approve a quota of 595 bbl. daily for Hunt Oil Co. on similar grounds.

British Columbia hopes to realize $2,500,000 from the sale of petroleum and natural gas rights on 336,000 acres of land in the Peace River area from Dawson Creek to the British Columbia-Yukon border. The provincial mines department will put the rights on sale July 30. Included will be 45 parcels ranging from 60 acres to 59,420 acres.

Stekoll Petroleum has acquired oil and gas producing properties in Ochiltree and Hansford counties, Texas. They include 11 producing oil wells, 3 producing gas wells, and about 30 proven locations. Current daily production is 600 bbl. of oil and 2,000 M.c.f. of gas. Purchase was made from the Horizon Oil & Gas Co., Dallas.

Chiksan Co., Brea, Calif., a leading oil equipment manufacturer, recently purchased Hamer Valves, Inc., Long Beach. Hamer has been a major supplier of valves to the industry since 1928.



Layne pumps top more producing water wells

Layne Pump Design, manufacture and installation are only part of the complete water service offered by the Layne organization. Other services include: Initial surveys, explorations, recommendations, site selection, foundation and soil sampling, well drilling, well casings and screens, gravel wall wells, construction of water systems, complete research staff and facilities, maintenance and service, chemical treatment of water wells, water treatment. *Write for Bulletin No. 100.*

WORLD'S LARGEST Layne WATER DEVELOPERS

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LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

Shell Starts LPG

. . . pilot project in West Texas' huge Wasson field.

SHELL Oil Co. has started a pilot miscible drive which could expand into the industry's biggest, following approval of the project last week by the Texas Railroad Commission.

Shell will inject 300,000 bbl. of LPG in an LPG slug type drive into the San Andres pay under its 640-acre George Baumgart E lease in sprawling Wasson field, Yoakum County, West Texas (OGJ, June 29, p. 48).

If the pilot boosts recovery as much as hoped in the test area, the project likely would balloon out to cover much of giant Wasson's 63,000 acres.

Biggest project of this type in acreage is that operated by Magnolia Petroleum Co. covering the 7,800-acre Parks Pennsylvanian field in Midland County, also in West Texas.

Following injection of the LPG, Shell will inject dry gas at a rate of 1,300,000 cu. ft. daily through the same input well.

Making study . . . Shell is tackling the pilot as part of its current study of Wasson's secondary recovery potential. Results will help determine what fieldwide program or programs to propose to other operators.

Extensive studies to date indicate that a large portion of the reservoir is amendable to use of the miscible technique. Company engineers have found the San Andres to be interconnected between wells and permeability stratification not severe.

At Shell's request, the Railroad Commission approved transfer of the allowable of the input well and that of all producing wells on the lease to those nearest the input. The commission also approved a net gas-oil ratio rule with credit for LPG injected under the approved formula: 1 bbl. of propane would be equivalent to 500 cu. ft. of gas.

All wells on the lease will be exempt from gas-oil ratio surveys for the life of the pilot program. Also, the input well will be exempt from annual bottom-hole-pressure surveys. Finally, the commission approved a gas bank with a maximum volume of 1 month's injection and a 6 months' balancing period.

Truck Hauls Liquid Ethylene

NORTH AMERICA'S first shipments of liquid ethylene have been made in Canada. Imperial Oil Ltd., made the initial shipment to Carbide Chemical Co.'s Montreal East plant via a specially designed tank-trailer.

Ethylene, normally a gas, had to be refrigerated to a temperature of 155° where liquefaction takes place. The liquid product, loaded through special facilities at Imperial's Sarnia, Ont., petrochem plant, then was transported in king-size "thermos bottles."

These containers are 36-ft. long and 8 ft. in diameter and are heavily insulated with a plastic material. They are fitted with pressure relief valves and are so efficient they can travel in the sun for a week without vaporization of the ethylene taking place. The trip to Montreal takes less than 24 hours.

Pipe Is Aluminum Coated

ALUMINUM jacketing with a factory-baked enamel color finish was used over insulation on practically all process vessels and pipe lines in Superior Oil Co.'s new Lowry gas-processing plant near Lake Arthur, La.

All painting of insulated process pipes and vessels on the site was thus eliminated. Application of the prefinished colored aluminum jacketing was more economical than installation of unpainted metal jacketing with subsequent painting on the site.

Since the Lowry plant is of the refrigerated-absorption type, insulation was required on practically every vessel and pipeline. The enameled aluminum was specified for operational reasons as well as its eye appeal. The aluminum is coated on both sides in the manufacturing process. This increases protection to the jacketing.

Additional testing of prepainted aluminum may indicate that the sealing material between magnesia insulation and aluminum to prevent chemical reaction can be eliminated, with enamel serving the same purpose. This would reduce installation costs even further.

Exotic-Fuel Plant Sold

CELANESE CORP. of America is getting deeper into the exotic-fuel business.

The company is buying a plant in Asheville, N. C., which will be used for the development and eventual production of high energy chemical fuels for rocket and missile propulsion systems, according to Harold Blancke, president.

The plant will be owned and operated by Amcel Propulsion, Inc., in which Celanese will have a controlling interest. Present owner is Oerlikon Corp., Zurich, Switzerland, one of the world's foremost rocket and missile producers.

Navajo Leasing Due

. . . with bid opening slated July 28 on 21 small tracts.

THE NAVAJO Tribal Council will open bids at 10 a.m. July 28 on oil and gas leases on 21 small tracts of land—part of which is also claimed by the state of Utah.

Of the 3,291 acres involved, part is San Juan Riverbed. The rest is involved in litigation, with both Utah and the Navajos claiming ownership.

Glenn R. Landbloom, general superintendent of the Navajo Agency at Window Rock, Ariz., said awards will be based on the highest royalty percentage offers, and no royalty offers of less than 16 2/3% will be considered. The tribe has set a minimum fixed bonus of $500 per acre and annual rentals of $1.25 per acre.

The tracts are all in San Juan County, Utah, in the vicinity of oil and gas production.

Another leasing . . . The Navajo Council also will offer 17 sections of land for leasing later this summer.

Paul Jones, chairman of the council, said the land is "closely adjacent to a recent helium discovery." The land is southeast of Shiprock in San Juan County, New Mexico.

The U. S. Bureau of Mines recently announced plans to reopen its helium-processing plant at Shiprock.

Union Buys Leases

. . . in New Mexico, Texas from Odessa independent.

UNION OIL CO. last week acquired leaseholds, working interests, and royalty interests in more than 29,000 acres in 14 Texas and New Mexico counties from Judge Paul Moss of Odessa, Tex.

Purchase price was not revealed, but the cash transaction will add 12 million barrels of crude to the company's reserves.

Union also got 750 bbl. daily production from working interests and a like 750 bbl. daily from the royalty and mineral interests. The 1,500 bbl. daily is acquired from 428 producing wells on 22,000 acres. The remaining 7,000 acres have exploratory possibilities.

The deal also included one-half of the unleased deep rights of 8,400 acres in the South Cowden and Harper fields in Ector County, where prospects are held good for finding new production in the Devonian and Ellenburger formations.

Canyon Field Flood Is Ready

. . . as soon as Texas Railroad Commission gives approval.

Project aimed at boosting oil recovery by 19,000,000 bbl.

OPERATORS in SMS Canyon Sand field of Kent County, West Texas, plan an early start on a unit and water flood program which they expect will hike ultimate oil recovery from the field by 19,000,000 bbl.

All that is needed now is approval of the Texas Railroad Commission. And that is expected soon.

Spokesmen for Pan American Petroleum Corp., projected unit operator, told the commission that 97.1% of working interests and 98% of royalty interests have signed the unit agreement. State riverbed leases in the unit area, which takes in 38 separate tracts totaling 5,850 acres, also have been committed.

Via the unit and flood, operators estimate they'll produce an extra 19,000,000 bbl. of oil—valued at $56,000,000—with expenditures of just $2,500,000.

R. W. Feagan, petroleum engineer for Pan Am, said the unit plan is to use nine water injection wells in a line-drive type flood. Fresh water from gravel beds will be injected in a closed system under 2,000 psi. initial input pressure. Initial input rate will be 1,100 bbl. per well per day.

Field-wide . . . The projected flood will affect the entire field.

Feagan said there are now an estimated 4,093 productive acres in the reservoir—the Atkins sand of the Canyon series encountered from about 3,894 to 3,939 ft.

The pool is about 5 miles long. It is a stratigraphic trap bounded by a sand pinchout on the east and a water-oil contact on the west. Water influx is insufficient to move the oil. There is no gas-oil contact. Crude was undersaturated originally. Pay thickness averages 17 ft.

There now are 79 producing wells in the project area, Feagan said. And the field is in the intermediate stage of depletion. The wells produce an average 26 bbl. daily each.

When the pool was discovered in January 1954, reservoir pressure was 2,467 psi. This has now fallen to an average 650 psi. Meanwhile, the average gas-oil ratio has climbed to 600:1 from the initial 345:1.

Cumulative production in the 4½ years since discovery is 4,538,410 bbl.

Pan Am, as operator, asked the commission for an allowable transfer rule and an MER of 111 bbl. per well subject to shut-down days. As wells are converted to injection, current allowables would be transferred.

The order sought, Pan Am said, is patterned after that now in effect in South Cowden field in Ector County.

Saskatchewan Accepts Bids

SASKATCHEWAN has accepted $311,139 in a closed bid sale for oil and gas exploration permits on 12 blocks of wildcat acreage.

Seven companies were successful bidders on the 12 tracts, which total 1,067,359 acres. No bids were made on seven other blocks—totaling 688,344 acres—offered in the sale.

Sinclair Canada Oil Co. of Calgary entered the largest bid, $151,652.31, for rights to explore 99,040 acres in the Dollard vicinity in the southwestern area of the province. Pan American Petroleum Corp. of Calgary was second high bidder with an offer of $51,027.20 on 76,160 acres in the Webb-Instow district and another bid of $18,635 on 98,080 acres in approximately the same area.

PROCESSING BRIEFS . . .

Dow Badische Chemical Co. will produce acrylic acid and methyl, ethyl, butyl, and other acrylic esters at a Freeport, Tex., plant to be completed by December. Dow Badische is owned jointly by Dow Chemical Co. and BASF Overzee, N. V., a subsidiary of Badische Anilin and Soda-Fabrik, A. G., of Ludwigshafen a. Rhein, Germany. The plant, which has been under construction for 8 months, will manufacture acrylic acid as a 94% technical grade by a direct process developed by Badische.

Keel has been laid for a new liquid chemical tanker to be used by Dow Chemical Co. The vessel, being built at the Quincy, Mass., yard of Bethlehem Steel's shipbuilding division, is scheduled for launching about March 1, 1960. The 16,625-ton tanker will be leased to Dow by Marine Transport Lines.

A $1,800,000 alkylation unit will be built at Texaco Canada's East Montreal refinery. The unit will use refinery gases and light gasoline as feed stock to produce alkylate to be blended into gasoline. It will be constructed by Foster Wheeler, Ltd.

An 8,000-bbl. naphtha Unifining unit to clean up the charge stock to an existing Rexformer is being built at Aurora Gasoline Co.'s Detroit refinery. The unit, being built by Refinery Engineering Co., will be completed in November. Treco also is installing a 2,000-bbl. sulfuric acid alkylation unit at the plant.

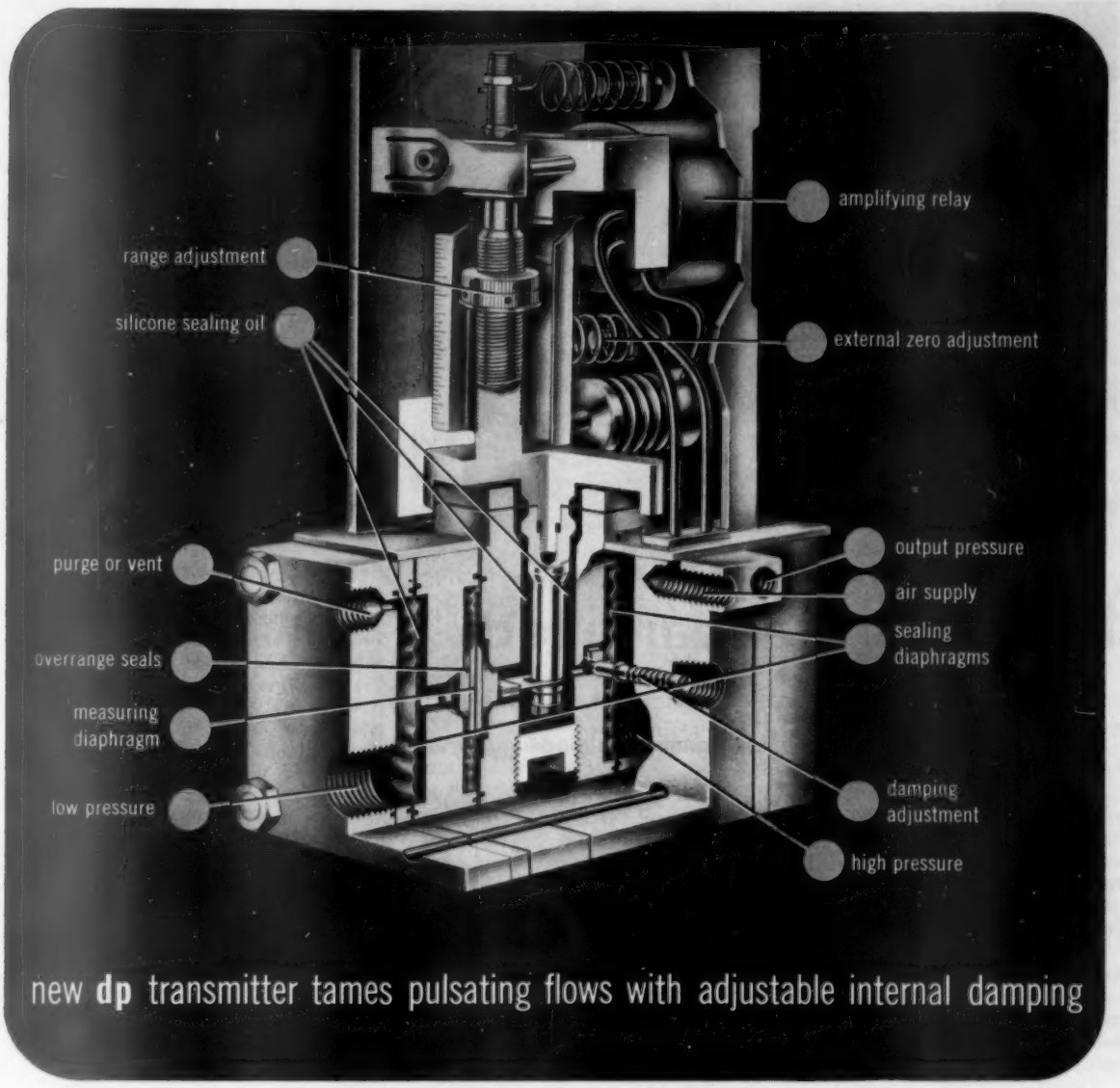
Two new phosphorus-containing additives have been developed for gasoline by Union Carbide Chemicals. The company said the two compounds, Ucar 4BP and Ucar 2CP, are recommended as pre-ignition suppressors and spark-plug antifouling additives. Ucar 2CP also is a lead-scavenging agent.

An underground LPG storage depot and a $1,750,000 evaporative salt plant will be built by Dakota Salt & Chemical Co. on a 600-acre site at Williston, N. D. The caverns, washed out of salt formations, each will have maximum storage capacity of 250,000 bbl. The salt plant, with designed capacity of 50,000 tons of high purity salt per year, will initially produce half that amount.

Also for Refiners . . .

IN THE NEWS: Main issue in new rash of refinery strikes is job assignments and working conditions (p. 61) . . . Modification in engine design will permit jet planes to use less fuel, fly greater distances, and carry heavier loads (p. 62) . . . Dowell develops chemical foam which solves many tough problems faced in cleaning industrial equipment (p. 70).

PLUS THESE TECHNICAL REPORTS: Locating tomorrow's chemical plants (p. 106) . . . CO boiler supplements refinery steam supply (p. 138).



new **dp** transmitter tames pulsating flows with adjustable internal damping

Not long ago, F & P engineers set about building a better differential pressure transmitter. Their main purpose: to obtain dp transmitting of the highest accuracy and dependability by providing adjustable internal damping, maintenance-free operation, and superior calibration stability. Their design approach: keep the process fluid out of the measuring system.

An examination of the illustration above reveals how the input pressures, applied to the sealing diaphragms, are transmitted to the measuring diaphragm by silicone sealing oil. Adjustable internal damping is achieved by a needle valve which restricts the flow of sealing oil. This ensures fast response to full changes in differential pressure, yet isolates the force balance system from extraneous impulses. Pulsating flows present no problems for this transmitter. And since the needle valve is in the clean sealing oil, its operation is trouble free, regardless of the amount of damping required.

The unique and revolutionary design of this new dp transmitter makes it well worth investigating. Contact the F & P field engineer nearest you for a demonstration or evaluation unit, or write for Catalog 10B1465. Fischer & Porter Company, 3179 County Line Road, Hatboro, Pennsylvania. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Downsview, Ontario.

FP **FISCHER & PORTER COMPANY** • *complete process instrumentation*

READY for calibrating to API standard is a Western Co. logging tool.

Loggings Standardized

. . . by API's new calibration facility at the University of Houston. It's available for commercial logging firms.

THE OIL industry took a major step toward standardizing radiation, or nuclear, loggings when the American Petroleum Institute's calibration facility was opened at the University of Houston for the use of logging companies.

The $48,000 facility will meet a long-time need for calibrating all industry nuclear logging tools. Equipment calibrated at the facility will obtain logs in terms of "API neutron units" and "API gamma-ray units."

The facility consists of two pits, one for gamma-ray logging and the other for neutron logging.

The neutron pit is 6 ft. in diameter and 25 ft. deep. It contains three 6-ft. layers of limestone of approximately 26%, 19%, and 2% porosity. Atop these layers is 7 ft. of water for water calibration.

Through the center of the pit is a 7⅞-in. water-filled open hole. A 15-ft. rat hole extends below the base of the pit.

The gamma-ray pit is 4 ft. in diameter and 25 ft. deep. It contains three 8-ft. cement layers of controlled radioactivity, topped by 1 ft. of water. The bottom layer has low activity content, the center layer high activity, and the top layer low activity. The pit's center hole has 5½-in. casing, water-filled, and a 15-ft. rat hole extends below it.

First use . . . The Western Co. was the first commercial company to use the facility for calibrating its equipment according to the newly established API RP33 standard.

Calibrating the tool involved logging the pits and calibrating at designated points.

In the gamma-ray pit, this calibration was accomplished by recording the deflection obtained from the low-radioactive cement to the high-radioactive cement. This deflection, by the new standard, is 200 API gamma-ray units.

The high-activity section was controlled to have a radioactivity response equivalent to approximately twice the average Mid-Continent shale. Two hundred API gamma-ray units will be assigned as the deflection between the bottom low activity and the center high activity zones. This will make 100 API gamma-ray units approximately equivalent to the average shale.

Calibrating in the neutron pit was done in a similar manner by stopping at a designated point in the 19% porosity zone and obtaining a deflection from instrument zero. The deflection between zero and the 19% porosity zone is, by the new standard, 1,000 API neutron units.

Development of the facility has been a 2-year project of a special API subcommittee, headed by W. B. Belknap, Phillips Petroleum Co. The API paid the cost of building the facility, and the logging companies will pay the operational costs.

Prof. C. V. Kirkpatrick, head of the petroleum engineering department at the University of Houston, is director of the project for the API and the university. Kirkpatrick said logging companies have booked up the facility for 2 weeks.

PIPELINE BRIEFS . . .

Permission to develop the nearly-depleted Otis field in south-central Kansas for underground storage of natural gas is being sought from the FPC by Northern Natural Gas Co. The company plans to store approximately 182 billion cubic feet of natural gas in the field, located in Rush and Barton counties. When fully developed, the field would be able to supply 350 million cubic feet a day.

A 24-mile 20-in. gas line will be laid by Mountain Fuel Supply Co. from Yellow Creek, Wyo., to Coalville, Utah. In addition 5.4 miles of 8-in. and 1.5 miles of 6-in. will be laid near Rock Springs, Wyo. The projects, awaiting FPC approval, are scheduled to be completed by October 15.

Contracts have been awarded by Okan Pipeline Co. for 33 miles of LPG line. Monarch Constructors, Odessa, Tex., is building a 28-mile 4-in. line from Mocane, Okla., to its Liberal, Kans., station to take products from a gasoline plant to its existing line. A 5-mile 4-in. connection with Shell Pipe Line Corp. is being laid near Cushing by Luther G. Harper, Tulsa. Both projects will be completed this month. A 10,000-bbl. butane storage tank is being constructed by Chicago Bridge & Iron Co. at Liberal.

A new 23-mile 8-in. products line and terminal near O'Hare field, Chicago, have been placed in operation by Standard Oil Co. (Ind.). The line has capacity of 30,000 bbl. per day serving the 476,000-bbl. terminal. The new facilities were built by Midwestern Contractors, Inc.; J. C. Harris & Sons; and General American Transportation Corp.

Expedition Leaves

. . . to make seismic study of thin spot in earth's crust.

A THREE-SHIP expedition is enroute to the Guadalupe Islands off Baja, Calif., to make seismic studies of possible sites for a project aimed at drilling through the earth's crust.

The study will be made by the Scripps Institution of Oceanography for the American Miscellaneous Society, directors of the so-called Mohole project.

The Mohole project calls for drilling a hole, probably from a floating drilling barge similar to those now used by the oil industry, through the earth's crust into the Mohorovicic discontinuity. The Mohorovicic discontinuity is found between the earth's crust and mantle.

The Guadalupe Island area is one of several under study as possible sites for the project. Its main attractions include mild ocean weather conditions plus proximity to onshore supply areas at San Diego, a relatively short distance to the north.

Another area under consideration is about 200 miles north of Puerto Rico on the abyssal plain.

Oil men help . . . Working closely with the AMSOC group and Scripps on the drilling problems of such a project has been the Global Marine Exploration Co., Los Angeles. Global Marine is the offspring of the former CUSS Group which conducted extensive core drilling in California waters several years ago.

The CUSS Group (Continental, Union, Shell, and Superior oil companies) built probably the most elaborate and efficient floating drilling barge for operating in deep waters in the business, the CUSS I. It is still being used by oil operators for drilling offshore parcels, but not as a CUSS Group operation. The 260-ft. converted Navy vessel is considered a good bet for an operation of the scope of the Mohole project.

An ideal site would be where the earth's mantle, with the Moho just above it, is closest to the earth's surface. Ocean depths offer the most promise for meeting that standard. For instance, the site north of Puerto Rico finds the Moho only 18,000 ft. below the earth's surface, which in turn is in 14,000 ft. water depth.

Gulf Wildcat at 13,628 Ft.

GULF Oil Corp. was drilling below 13,628 ft. last week on its way to a projected depth of 15,000 in its offshore wildcat in Florida waters.

The No. 1 826-Y State Lease, a tight hole, is about 15 miles northwest of Key West near the Marquesas Keys. Kerr-McGee's Rig 48 is drilling the test.

Offshore Florida is yet to get its first producer. Gulf and The California Co. recently acquired 23 tracts of federal leases just west of the test well.

Pipelines Seek Gas

. . . in Canada for Midwest markets. FPC hearing set.

PLANS for importing Canadian gas to serve markets in the upper Midwest will be presented at hearings starting July 27 before a Federal Power Commission examiner in Washington.

Hearings will involve expansion proposals by Midwestern Gas Transmission Co. and Michigan Wisconsin Pipe Line Co.

Midwestern is seeking authority to build a $52,297,000 pipeline system from the U. S.-Canadian border near Emerson, Man., to Marshfield, Wis. The company plans to purchase approximately 204,000,000 cu. ft. of gas daily from Trans-Canada Pipelines, Ltd., for resale in this country.

Michigan Wisconsin proposes to build 97 miles of main line from Marshfield to Appleton, Wis., and to add other facilities at a total cost of about $24,177,000 to handle gas purchased from Midwestern.

Michigan Wisconsin would take 158,000,000 cu. ft. of gas per day from Midwestern for resale in Wisconsin and Michigan. Remainder of the Canadian supply would be sold to Northern States Power Co., Montana-Dakota Utilities Co., and United Petroleum Gas Co., all of Minneapolis, and to nine Minnesota communities.

Four companies have joined in the competition to build a crude-oil pipeline to serve northeastern British Columbia fields. Permission of the provincial government is being sought by Gibson Associated Oils, Ltd.; Trans Prairie Pipelines, Ltd.; Pacific Petroleums, Ltd.; and Peace River Oil Pipe Line Co., Ltd. Proposals call for construction of lines from the Milligan Creek area, 50 miles north of Fort St. John, to Fort St. John and Dawson Creek, B. C., refineries, and also to the Alberta system of Peace River.

Construction has started on a 12-mile 16 and 20-in. gas line in the Toledo area for Ohio Fuel Gas Co. Shamrock Construction Co. has the contract.

The rapid growth in the Vancouver area natural-gas demand will result in construction of a 4-mile 30-in. line costing $7,500,000 to supplement an 18-in. line connecting Westcoast Transmission, the supplier. British Columbia Electric will build the new line. Westcoast plans a 22-mile extension to connect reserves which Pacific Petroleums will develop in the Jedney and Bubbles areas of the Peace River region in northeastern British Columbia.

Contracts to lay pipe at six river crossings have been awarded by Midwestern Gas Transmission on its 350-mile 30-in. pipeline into the Chicago area from Portland, Tenn. Contracts were let to: Sharman, Allen, Gay & Taylor, Inc., Green River in Kentucky; Pentzien, Inc., Ohio River on the Kentucky-Indiana state line; Popich Marine Construction, Inc., White and Wabash rivers in Indiana; Missouri Valley Dredging Co., Kankakee River in Illinois; and Collins Construction Co., Des Plaines River in Illinois.

Contract to build some 19 miles of 26-in. line for Atlantic Seaboard Corp. has been awarded to H. L. Gentry Construction Co. Gentry will install a 2,230-ft. crossing of the Shenandoah River along with loops of 7.6 miles, 6.1 miles, and 5.7 miles in West Virginia. The contractor should be in full swing next week.

Also for Pipeliners . . .

IN THE NEWS: FPC plans to speed a decision on expansion plans of Texas Gas Transmission and Texas Eastern (p. 67) . . . Hearings set on plans of two pipelines seeking gas in Canada for Midwest markets (p. 83).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are carried in pipeline briefs.

PLUS THIS TECHNICAL REPORT: A special section on pipeline costs (p. 89-104).

Arabia's Empty Quarter... a challenge to oil men

ONE OF THE WORLD'S largest mobile rigs is helping crack open the geology of the desolate Rub' al-Khali in southern Saudi Arabia.

The unit is a truck-mounted T-32. It has a key role in the exploration push by Arabian American Oil Co. in Rub' al-Khali, the Arabic term for Empty Quarter. The region is a vast desert of sand and gravel almost the size of Texas.

In the past 2½ years the area has become the main arena in Aramco's exploration program. In addition to gravity meter-magnetometer and seismic parties in the field, the company has kept three drilling crews on stratigraphic work, using rotary rigs.

The heaviest piece of equipment is the truck-mounted T-32. It has drilled two tests since going into the quarter last summer and is now being moved 206 miles across roadless country for the third location.

The rig is being transported on three trailers. One carries the rig unit itself, which weighs 213¼ tons. The second holds the mud pumps, while the third carries drill pipe and collars. Caterpillar tractors furnish additional pulling power on the move.

Argentina's Oil Policies Are Bolstered

- Frondizi's new cabinet officer is champion of free enterprise and a strong supporter of domestic oil development by foreign firms.

THERE are signs that Argentina's new oil policies may be more firmly established than ever after weathering a severe political storm.

One of these signs is the appointment of Alvaro Alsogaray as head of the economics ministry. This cabinet post controls the oil industry, and the 46-year-old Army engineer has been a champion of free enterprise and an outspoken advocate of foreign aid for the development of the local oil industry.

The appointment was made by President Arturo Frondizi after an internal tug-of-war in which the entire cabinet and several top echelon members of the state oil agency, YPF, resigned.

Oil, for a change, was not a prime issue in the conflict. The trouble arose over dissatisfaction by military groups, who put pressure on President Frondizi to stop alleged favoritism of leftist and Peronista groups.

If control had slipped from President Frondizi's hands, however, the fate of recently signed agreements with foreign oil companies would have been a question mark.

Frondizi, put into office by labor, alienated the working class and won support of the military with his strike-breaking tactics. His position became shaky when he lost some of the military backing.

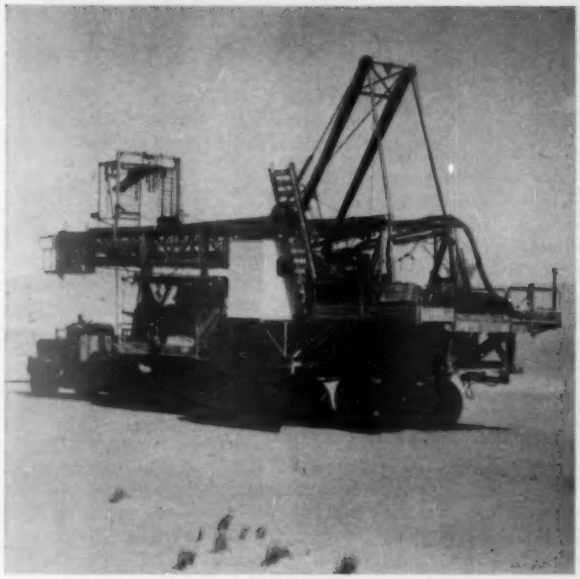
Alsogaray reportedly has the backing of the military. So his appointment as economics minister should strengthen Frondizi's position.

Alsogaray is head of the small Civic Independent party. He also has been appointed temporary labor minister with the right of selecting the permanent minister. This post has a bearing on the country's oil industry because of a voice in economic policies.

Another indication . . . The second sign that present oil policies will probably be continued was the reinstatement of Horacio Aguirre as president of YPF.

Aguirre was one of the YPF members who turned in his resignation after the mass resignation by the cabinet.

Alsogaray, however, rejected the Aguirre move, meaning that the working arrangement between YPF and



BEING MOVED across the trackless Rub' al-Khali desert of southern Saudi Arabia is Aramco's T-32 rig, one of the largest mobil units in the world. The rigs weigh 213¼ tons. The truck-mounted rig gets extra pulling power from a caterpillar tractor.

AN ARAMCO employe checks tire pressure, which is very important when heavy loads are moved across the desert. This trailer hauls the rig, while two others carry mud pumps, drill pipe, and collars.

foreign companies can continue without interruption.

Oil activity . . . Development contracts signed with foreign companies in the last year have caused a resurgence in the Argentine oil industry.

Pan American International has agreed to spend $60 million over 15 years, and a group headed by Carl M. Loeb, Rhoades & Co., will spend $100 million over 20 years.

Subsidiaries of Royal Dutch-Shell and Standard Oil Co. (N. J.) have made exploration agreements. Other companies holding contracts with YPF include Union Oil Co., Laughlin-Porter Drilling Co., and Lane-Wells Co.

YPF itself has been responsible for recent crude production gains which have pushed output to as high as 126,000 bbl. daily this year. This volume will be supplemented as soon as field development by private companies mounts up.

Another boost in output will come next year when a crude pipeline from Salta Province permits the opening of shut-in northern fields.

Esso Plans Refinery in West Germany

A 60,000 to 85,000-bbl. refinery will be built at Karlsruhe, West Germany, by Esso A.G.

The Standard Oil Co. (N.J.) affiliate expects to complete the plant late in 1962 and place it in operation on January 1, 1963. The refinery will supply gasoline, jet fuels, diesel oil, and heavy fuel and heating oils to south German markets.

The new plant will be one of five proposed projects to be served by the South Europe pipeline, which will run 475 miles from the Lavera area, near Marseille, northward across France to Strasbough and up to Karlsruhe, West Germany.

Work on the big-inch system will start as soon as the French Government gives its official approval. A group of 16 companies have applied for permission to build the crude line, and the proposal has already been endorsed by the French cabinet.

The line is expected to open in 1962, earlier than previously anticipated. Initial capacity will be 200,000 bbl. daily. Estimates of future throughput have been raised to 500,000 bbl. daily.

Cost of the system is expected to exceed $100 million. The operating company, Ste. du Pipeline Sub-Europeen, had been planning a 30-in. main line in France, with a 40-mile feeder to Karlsruhe, West Germany.

The system will run underground along the west bank of the Rhone River and pass between the Vosges and Jura mountains. It will be laid above ground on the French side of the Rhine river as far as Karlsruhe, where a river crossing will be made.

Five refineries have been proposed in connection with the project. Two are being considered for Karlsruhe, two for Strasbourg. Another plant is to be built near Chalon, a city in east central France.

Participants in the venture include Socony Mobil, Caltex, Jersey Standard, Royal Dutch-Shell, British Petroleum, CFP, Petrofina, and local West German and French firms.

Refinery Started

. . . in West Germany. It's to go on stream in fall of '60.

GROUND has been broken for a 30,000-bbl. refinery to be built at Emden, West Germany, by Erdoelwerke Frisia A. G.

The start of construction marks a victory for Gottlieb Duttweiler, the head of Frisia.

The plant is expected to go on stream in the fall of 1960. Construction is being supervised by Ralph Parsons Co. A 15-year contract for Neutral Zone crude has been signed with American Independent Oil Co.

Fuel oil will be the leading product, with a design yield of 20,000 bbl. daily. The remaining 10,000 bbl. daily will consist largely of gasoline and diesel oil. Frisia plans to sell 10% of the fuel oil in Denmark, and 10 to 20% in Switzerland.

The plant is being built on a 173-acre site on the Ems River. The Lower Saxony government is helping to build a harbor that will handle tankers up to 24,000 tons. Larger ships will have to be serviced by barges. Refinery design will enable the doubling of capacity later.

Gulf Moving Rig to Libya

GULF OIL CORP. is bringing in a second rig to help evaluate its Emgayet discovery in northwestern Libya.

A rig rated at 6,000 ft. has been transferred to Libya from the company's operations in Sicily. Last week it was being trucked to concession 66, located 200 miles south of Tripoli.

Emgayet 1 came in as a 750-bbl. producer of 35°-gravity clean oil from a section at about 4,100 ft. The wildcat is in the middle portion of the 7 million acre concession.

To the northwest, Libya Shell has reached 12,014 ft. in its Bir Tlacsin discovery to set a new depth record for the country. The well is drilling ahead. It is 120 miles southwest of Tripoli and may be good for 1,000 bbl. daily.

Colombia Has Producer

A THIRD producing well has been brought in by Cities Service Co. on Las Monas structure in the 2-million acre El Carare area of Colombia.

The well has an indicated potential of 800 bbl. daily, producing from 99 ft. of perforations at depths ranging from 4,700 to 6,372 ft. The operating subsidiary, Colombia-Cities Service Petroleum Corp., has an active drilling program under way to determine the extent of the field.

Partners in the joint venture are Richfield Oil Corp. and the government company, Empresa Colombiana de Petroleos. The group began exploring the El Carare area, lying 300 miles up the Magdalena river, 4 years ago. The region lies between Empresa's fields in the Demares concession, and the Teran Guaguaqui property, owned by Texas Petroleum Corp.

Aramco to Produce

. . . frigid LPG for tankers at new Persian Gulf plant.

THE WORLD'S first plant making refrigerated LPG available for tanker shipment will be built on the Persian Gulf coast of Saudi Arabia.

Arabian American Oil Co. is building a $5,250,000 plant to make refrigerated LPG available for offshore sales from its Ras Tanura terminal. The new plant is scheduled for completion in August 1960.

The LPG unit will cool gas to −25° F. to permit export shipments in special refrigerated tankers. Its capacity will be 4,000 bbl. per calendar day.

New facilities will include two 80,000-bbl. steel tanks for storing the refrigerated LPG at atmospheric pressure. Loading pumps and a 22-in. pipeline will carry the liquid to Ras Tanura's north pier for loading in LPG tankers.

LPG will be produced at Aramco's Ras Tanura refinery. Propane will be gathered from the polymerization plant, and both propane and butane will be taken from the alkylation unit. Sulfur and water will be removed from the gases.

The refrigeration plant will be the newest installation in Aramco's program for utilizing and conserving gases. Gas-injection plants at Abqaiq field and in the Ain Dar area of Ghawar field make possible conservation and industrial use of 66% of the gas produced with oil in Saudi Arabia.

FOREIGN BRIEFS . . .

An airborne magnetometer survey over parts of Ireland, northern England, southern Scotland, and the Irish sea will be carried out this summer by Canadian Aero Service, Ltd., Ottawa. The survey will cover more than 22,000-sq. miles.

A second shipment of drilling equipment has been shipped to the Indian Government by Romania. The order includes two rigs and other gear.

Columbian Carbon plans to build a $6-million carbon-black plant near Milan, Italy. The plant will produce 60,000,000 lbs. of carbon black annually. Columbian's engineering staff will design the plant, but Italian companies will handle the construction. The plant will go on stream early in 1961. E. B. Brooks, vice president in charge of the company's carbon black and pigment division, has been named chairman of Columbian Carbon Europa, a new company which will operate the Milan plant.

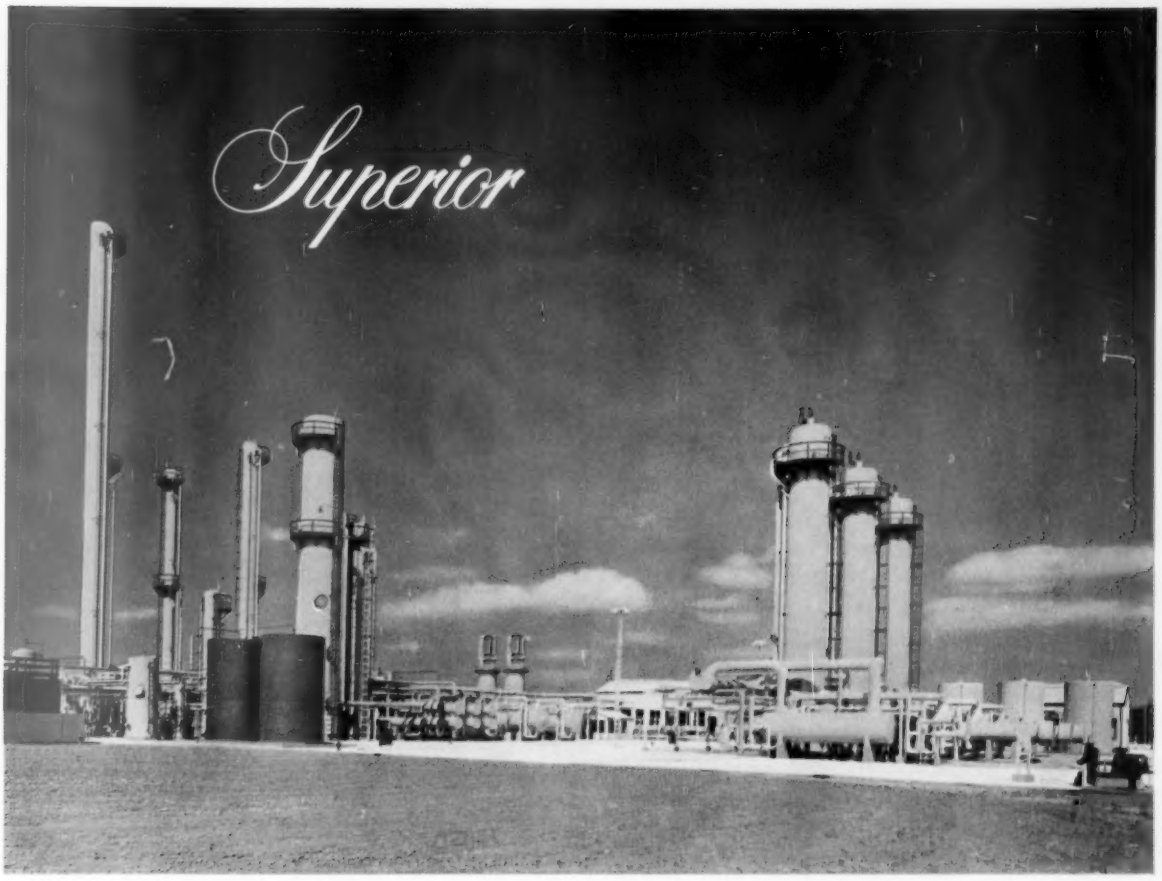
A new company to produce styrene monomer in Australia has been formed by Monsanto Chemical Co. and Petroleum & Chemicals Corp. of Sydney, Australia. The new company, Australian Petrochemicals, Ltd., will build a plant at Silverwater, near Sydney. Manufacturing operations are scheduled to begin in 1961.

Three blocks totaling about 27,000 acres in the greater Oficina area of Eastern Venezuela have been farmed out to Stekoll Petroleum, of Dallas, by Pancoastal Petroleum and Venezuelan Atlantic Refining. The farmout is a part cash, part royalty agreement, and Stekoll will drill at least eight wells.

The Lebanese parliament has unanimously approved a new royalty agreement with Iraq Petroleum Co. which increases the country's transit fees for pipeline shipments of crude to Tripoli to $3,450,000 a year. A $16.3-million lump sum also will be paid to cover past claims.

Preliminary exploration is slated to start soon on Stekoll Petroleum's huge 52,000,000-acre concession in northeastern Queensland, Australia. The company has retained Dr. David W. Trexler, professor of geology at Colorado School of Mines, to supervise an aerial survey of the concession. Part of the concession extends to the Great Barrier Reef.

Exploration rights on the 81,000-sq.-mile concession were obtained from the provincial government of Queensland. There are no drilling or acreage-selection obligations.



MORE THAN MEETS THE EYE

Pastel and bright color combinations used in this Hudson designed and built plant are utilitarian and also pleasing to the eye.

But beyond the eye appeal is the built-in 30 years experience of Hudson in building gas processing plants in most gas producing regions of the free world.

Such experience combined with constant alertness for improvements results in trouble-free plants, built on time, with careful balance between capital cost and operating cost to assure maximum return on the investment.

The above pictured absorption plant processing 300 million cubic feet per day of gas at about 1000 pounds pressure is located on the Mermentau River in Cameron Parish near the Louisiana Gulf Coast, and was designed and built for the Superior Oil Company.

A refrigerated absorption process is used with provision for future further refrigeration down to minus 50°F to increase gas throughput and/or product recovery. The plant has operated uninterruptedly since initial test start-up in October 1958.

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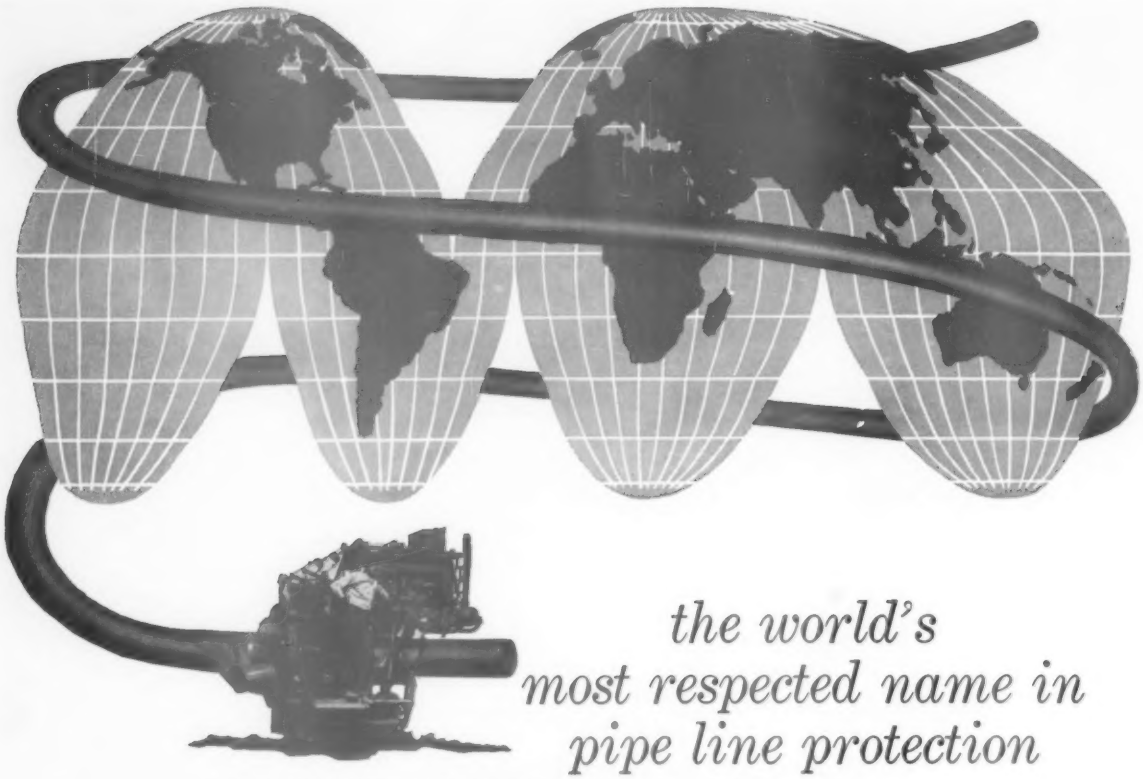

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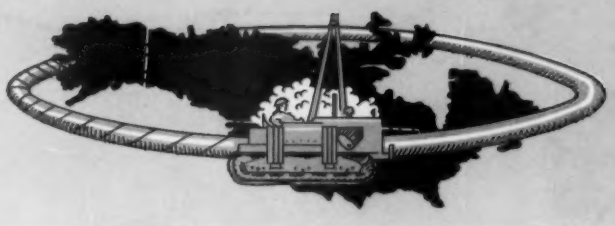
Pipeline Costs Vary All Over the Map



BY PAUL REED AND GENE KINNEY
Pipeline Editors

THE COST of building, operating, and maintaining oil and gas pipelines is examined in this special report. Certain rules of thumb are presented and significant trends are highlighted to point up interesting aspects of costs in various situations.

The analyses on the following 15 pages are based on government and industry records. From them, two facts stick out: (1) the wide variations in costs for performing the same operations in the same general area, and (2) the progress of efficiency in the pipeline industry which either partially or wholly counteracts the effects of labor and materials inflation.

Construction costs presented here are estimates and are intended to be general in nature. The rule-of-thumb figures must be modified to fit varying conditions. They cannot legitimately be applied to estimating the actual cost of a project without appropriate adjustments which could be made only by a qualified pipeline engineer. The indiscriminate use of such general rules of thumb to determine valuation of an existing system or to estimate a new system will likely produce erroneous results.

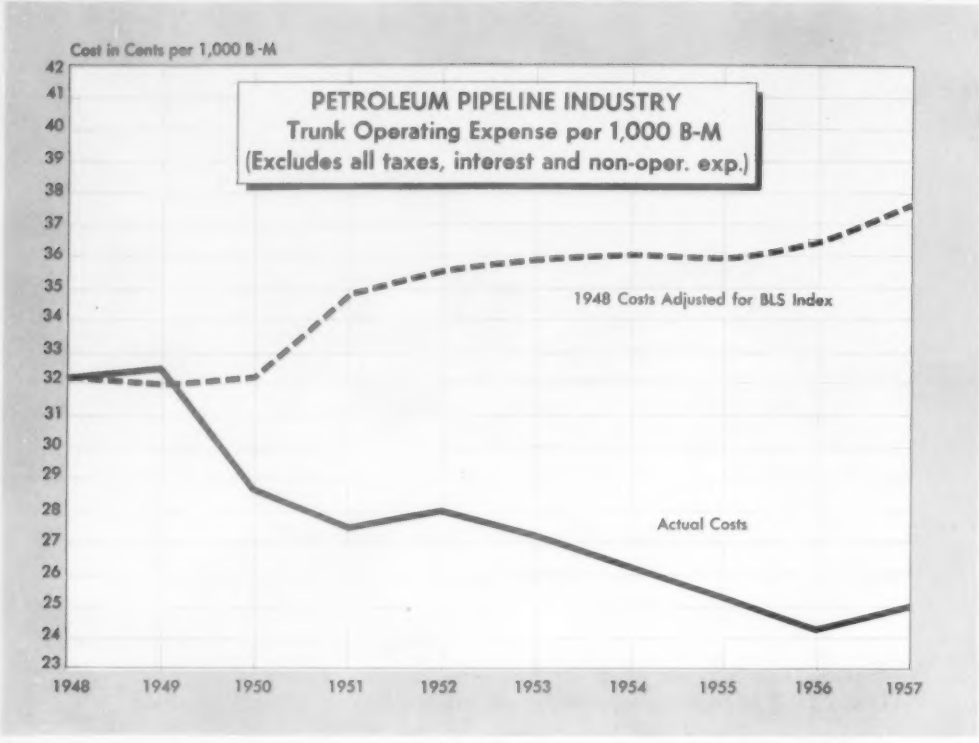


Fig. 1.

Oil-line operating costs drop 23% in 10-year period

. . . from 32.2 cents per 1,000 B-M to 24.9 (1948-1957)

THE ADVANCES of modern pipelining, particularly with respect to lines built during the past 10 years, have borne fruit in decreased unit operating costs.

This has been possible because of tremendous investment made to effect economies. Trunk investment has more than doubled from 1948 to 1957. The pipeline industry has spent billions to modernize. The motive has been the same as in all other private businesses: the need to meet competition. In many cases the result of large expenditures has been decreased revenues because rates were reduced to make a system competitive.

The operating economies of large diameters and remote control are reflected in Fig. 1. Trunk operating

TABLE 1—COST PER THOUSAND BARREL-MILES FOR TRANSPORTING CRUDE OIL IN 1957 THROUGH LINES OF COMPANIES SELECTED TO EXEMPLIFY DIFFERENT TYPES OF OPERATION

	Operating expense (in thou.)	Bbl.-miles (in millions)	Cost per 1,000 bbl.-miles
Large extended system			
Line 1	$24,366	137,223	$0.177
Short trunk lines			
Line 2	3,776	13,754	0.274
Line 3	904	3,452	0.209
New large-diameter trunk lines			
Line 1	5,908	46,070	0.121
Line 2	3,643	56,553	0.064
Line 3	5,162	40,415	0.127
Line 4	2,083	17,905	0.111

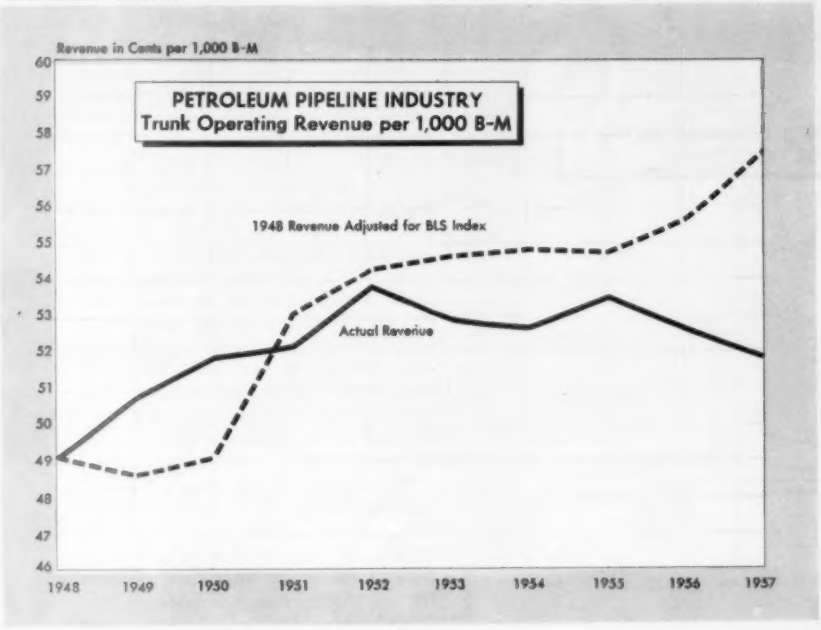


Fig. 2.

TABLE 2—COST PER THOUSAND BARREL-MILES FOR TRANSPORTING PRODUCTS IN 1957 THROUGH LINES OF COMPANIES SELECTED TO EXEMPLIFY DIFFERENT TYPES OF OPERATION

	Operating expense (in thousands)	Bbl.-miles (in millions)	Cost per 1,000 bbl.-miles
Upper Midwest (short lines)			
Line 1	$1,497	3,612	$0.414
Line 2	1,073	1,422	0.683
Line 3	287	420	0.683
Western Plains area			
Line 1	204	237	0.860
Line 2	969	1,145	0.840
Line 3	484	459	1.054
Long Lines			
Line 1	12,014	57,528	0.209
Line 2	19,689	45,906	0.428
Line 3	1,713	3,127	0.547
Line 4	3,038	5,225	0.598
Line 5	1,045	2,489	0.411

expense of the U. S. petroleum-pipeline industry decreased from 32.2 cents per thousand barrel-miles to 24.9 cents in the period 1948 through 1957. This is a decrease of 7.3 cents or about 23%. These figures do not include any taxes or interest and other nonoperating expense.

These statistics, based on company reports to the Interstate Commerce Commission, include data for refined-products pipelines as well as crude-oil lines. Costs of refined-oil transportation are not separable except for those companies which transport only refined oils.

In the 10-year period considered, refined-oil traffic has risen from 14% of the total petroleum-pipeline traffic to 21% of the total. It costs more to transport refined oils than to transport crude oil. In 1957 the cost per thousand barrel-miles of those companies transporting only refined oils was 35 cents as compared to the industry cost (including refined oils) of 24.9 cents. And so we may assume that, if it were possible to separate the cost of transporting crude oil only, the decrease in unit trunk operating expenses would have been greater than the 7.3 cents for all petroleum lines.

On the other hand, actual trunk revenue per thousand barrel-miles has increased from 49.1 cents to 51.8 cents (Fig. 2). This is an increase of 2.7 cents or about 5.5%, which is very small in view of an increase of some 20% in the Bureau of Labor Statistics price index.

Explanation of Revenue Trends

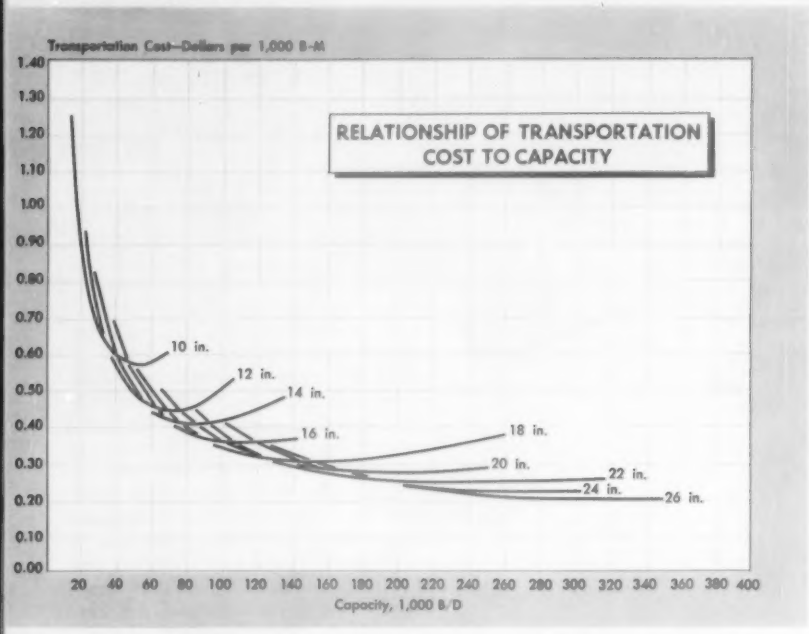
The revenue trend, however, is downward from the 1952 peak. The effect of steady modernization investment, and resulting lower rates, began to be felt in lower revenues. And revenues in constant dollars in 1957 were well below the 1948 level, as Fig. 2 shows.

Here are some of the factors which have affected revenues and expenses:

- Federal income-tax rates have

TABLE 3—PRINCIPAL MAINTENANCE AND OPERATING PERSONNEL AND THEIR COMPENSATION, 1953 AND 1957

	1953			1957		
	Average number	Compensation (in thou.)	% / total	Average number	Compensation (in thou.)	% / total
Gagers, deliverymen, and receivers	4,219	$22,821	24.7	4,177	$27,028	26.5
Station engineers and pumpers	4,755	25,757	27.9	3,871	24,662	24.2
Pipeline repairmen	3,420	14,880	16.1	2,661	14,022	13.8
Foremen and assistant foremen	1,773	10,845	11.7	1,809	13,592	13.4
Professional and subprofessional employes, engineers, chemists, etc.	977	5,704	6.2	1,099	8,063	7.9
Field superintendents	533	4,716	5.1	565	5,956	5.8
Machinists	433	2,417	2.6	351	2,191	2.2
Electricians	178	1,012	1.1	243	1,631	1.6
Other mechanics (skilled trades)	771	4,220	4.6	730	4,697	4.6
Total	17,059	$92,372	100.0	15,506	$101,842	100.0



LARGE-DIAMETER economy is emphasized by these curves based on Mid-Continent crude oil and average conditions. Fig. 3.

risen from 38% to 52%. Other tax rates have also increased proportionately. Total taxes have increased from $65 million in 1948 to $161 million in 1957. This is an increase of 148%, whereas in the same period traffic has increased only 97%.

- Interest on borrowed money has increased from $4 million in 1948 to $33 million in 1957.
- Trunk investment has increased from $1.1 billion in 1948 to $2.4 billion in 1957. This additional investment resulting in additional valuation, and also increased valuation resulting from increased cost of reproduction, entitled the owner to greater earnings.

The increase in tax and interest per thousand barrel-miles is about 5 cents.

Operating Cost Variations

Operating costs fluctuate widely from system to system, among crude and products lines, and between the two types of lines, as can be seen in Tables 1 and 2. A perusal of the tables exposes the fiction of "average" figures. Among the products lines listed, there is only one that is below the average in operating costs. But its volume is sufficient to offset the smaller lines which have operating costs that are several times as great as the large-diameter long line with high volume.

The advantages of modern design are evident in the crude-line table as well. The lines selected were built during World War II or later or have been modernized since that time. They therefore have operating costs that are, with one exception, well below the industry average. Fig. 3 also underlines the axiom that there is no substitute for large diameter.

Petroleum-pipeline traffic increased 28% during the 1953-57 period compared with an increase of 18% for total operating costs. Unit costs have continued a steady decline broken only by the abnormal situation caused by the Suez Canal closing in late 1956. Under this stimulus pipeline throughputs were unusually high in 1956 and early 1957. But the oversupply of crude which followed depressed traffic so that the gains of early 1957 were almost entirely lost. Operating costs during the year increased more than traffic (3.7% against less than 1%), thereby causing the temporary reversal in the downward trend of unit costs.

The decline in unit costs has paralleled the decline in the number of employes. The industry has been performing a steadily larger task with fewer men. While total compensation for employes has increased 9.5%, their number has actually decreased 9.6%.

Numbers and compensation for selected personnel categories are listed in Table 3, which shows the general trend is for supervisory and professional personnel to increase and for other groups to decrease.

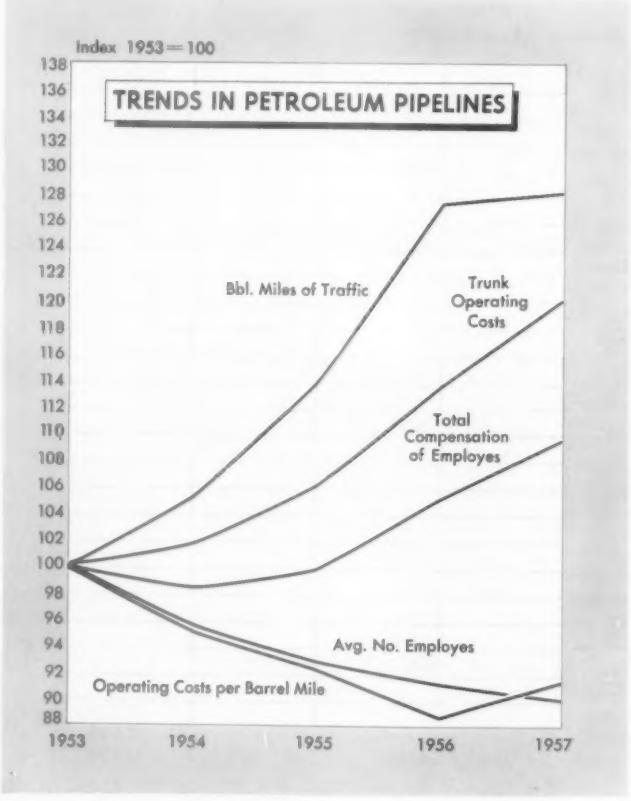
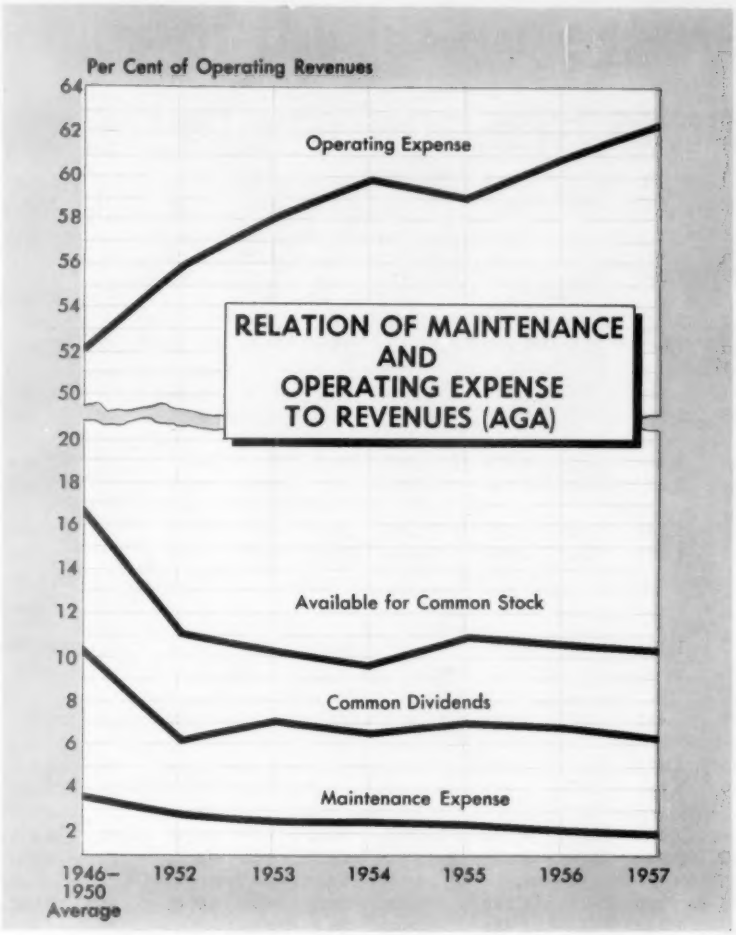


Fig. 4.



Operating costs of gas lines take bigger bite out of revenue

. . . but costs related to stations alone hold steady

COMPRESSOR-STATION costs vary considerably from company to company, but they have remained surprisingly stable for the 1952-57 period covered in Table 2.

The average for the 17 companies selected to represent different geographical areas and different types of operation was $25.50 per installed horsepower in 1952. The importance of various components shifted during the period but the 1957 average was exactly the same as 1952—$25.50 per horsepower.

This was largely because of a sharp reduction in costs by the largest company in Table 2 which had exceptional expansion in the period. Most lines had both increased labor and fuel costs.

Average size of compressor stations increased from 8,835 hp. in 1952 to 12,665 hp. in 1957, amounting to 30%. Along with the trend toward increasing the size of stations was a trend to reduce the labor cost per installed horsepower.

It is interesting to note that the highest total cost per horsepower ($43.10) is for a system with the lowest average station horsepower (4,446 hp.) among this group of lines. The lowest cost ($9.10) is found on the line with the largest concentration of horsepower (30,191 hp. per station). Although larger station size generally contributes to lower unit labor cost, no direct correlation can be made in these figures.

Labor and fuel comprised just under 50% of total operating costs in 1952 and again in 1957. However, their individual share of the total switched. Labor costs dropped from 29.5% to 25.3% of the total while fuel increased from 18.3% to 23.5% of the total. Fuel would have increased more but for the influence of the large system whose costs actually declined.

Supervision and engineering de-

TABLE 1—RELATION OF MAINTENANCE AND OPERATION EXPENSE TO OPERATING REVENUES OF NATURAL GAS TRANSMISSION COMPANIES, 1946-1957
(Per cent of operating revenues)

	1946-50 average	1952	1953	1954	1955	1956	1957
Total operating revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Maintenance expense .	3.6	2.8	2.6	2.6	2.4	2.3	2.2
Operation expense ...	52.1	56.0	58.3	60.6	59.2	60.9	62.4
Available for common stock	16.8	11.1	10.3	9.7	11.0	10.6	10.3
Common dividends ...	10.4	6.2	7.3	6.8	7.2	7.0	6.4

TABLE 2—COMPRESSOR-STATION OPERATING EXPENSES
(In thousands of dollars)

System from—Panhandle-Hugoton		Fuel	Sup. & engr.	Labor	Supplies & exp.	Other	Total exp.	Total trans. (hp.)	$/hp.	Fuel, $/hp.	Labor, $/hp.	No. stations	Hp. per station
Line 1	1952	177	169	728	480	9	1,564	69,595	22.6	2.54	10.46	11	6,326
	1957	407	346	920	709	33	2,416	98,735	24.5	4.12	9.32	14	7,066
Line 2	1952	570	411	1,285	901	95	3,262	140,620	22.1	4.05	9.14	28	5,022
	1957	1,034	504	1,637	1,390	123	4,689	163,980	28.6	6.31	9.98	31	5,289
Line 3	1952	1,049	587	2,507	1,553	345	6,042	241,920	24.6	4.34	10.36	20	12,096
	1957	3,240	1,000	3,654	3,982	413	12,290	421,160	29.2	7.69	8.68	24	17,548
Line 4	1952	563	348	1,331	864	11	3,117	154,000	20.2	3.66	8.64	12	12,823
	1957	1,615	322	1,813	2,038	65	5,853	199,500	29.3	8.10	9.09	12	16,625
Line 5	1952	2,819	511	2,469	3,464	464	9,726	269,280	36.1	10.47	9.17	20	13,464
	1957	2,052	1,011	2,901	3,807	476	10,246	293,240	34.9	7.00	9.89	23	13,010
Line 6	1952	893	351	1,048	1,241	146	3,689	139,200	26.4	6.42	7.53	15	9,280
	1957	1,025	454	1,492	1,926	356	5,253	150,010	35.0	6.83	9.95	15	10,000
Gulf Coast													
Line 1	1952	....	....	....	....	....	.....	.....	....	....	....	..	.....
	1957	858	250	572	1,136	463	3,279	140,550	23.3	6.10	4.07	11	12,777
Line 2	1952	....	....	....	....	....	.....	.....	....	....	....	..	.....
	1957	246	277	343	480	38	1,420	58,000	24.5	4.24	5.91	5	11,600
Line 3	1952	1,419	1,121	1,345	1,917	641	6,443	259,200	24.1	5.47	5.19	19	13,642
	1957	2,481	964	2,022	3,000	492	8,959	342,160	26.2	7.25	5.91	25	13,682
Line 4	1952	156	262	817	340	689	2,264	128,700	16.5	1.21	6.35	30	4,290
	1957	575	378	1,218	843	876	3,889	145,790	26.7	3.94	8.35	31	4,702
Line 5	1952	223	231	371	390	14	1,229	50,000	24.5	4.46	7.42	5	10,000
	1957	884	324	1,088	1,150	40	3,486	130,000	26.8	6.80	8.31	11	11,818
Line 6	1952	2,124	1,141	3,777	3,076	15	9,133	471,820	19.3	4.50	8.01	24	15,493
	1957	5,169	2,482	5,177	6,092	36	18,957	615,245	30.8	8.40	8.46	37	16,628
Line 7	1952	841	401	928	1,194	379	3,744	140,250	26.7	6.00	6.62	20	7,012
	1957	1,566	747	1,608	2,000	673	6,595	196,540	33.6	7.97	8.18	22	8,933
Line 8	1952	603	783	1,636	8,974	268	12,264	357,410	34.2	1.69	4.58	36	9,925
	1957	2,162	811	2,453	11,623	541	17,591	456,570	38.5	4.74	5.37	48	9,511
Line 9	1952	248	132	358	348	160	1,247	32,000	39.0	7.75	11.19	4	8,000
	1957	892	409	1,109	1,084	257	3,750	95,050	39.5	9.38	11.67	13	7,311
West Texas													
Line 1	1952	750	296	1,337	1,174	...	3,557	206,880	17.2	3.63	6.46	22	9,403
	1957	3,514	465	3,162	4,435	...	11,576	1,268,033	9.1	2.77	2.49	42	30,191
Appalachian area													
Line 1	1952	728	161	1,053	914	174	3,029	95,875	31.8	7.59	10.98	26	3,687
	1957	1,072	225	1,000	1,301	236	3,834	88,930	43.1	12.05	11.24	20	4,446

clined slightly from 9.5% to 8.9% while compressor-station supplies and expenses, the largest single item, remained the same at about 38%. The miscellaneous "other" supplies and expenses decreased from 4.7% to 4.1%.

The relation of maintenance and total operating expense to revenues is shown in the chart. The figures on which the chart is based are contained in Table 1. They show that operating expenses have increased more than revenues every year but one for the period shown. Maintenance expenses have decreased slightly. After dropping sharply from the 1946-50 average, the revenues available for common stock and common dividends have remained fairly stable.

Rules of thumb for estimating pipeline construction and operating costs

FROM CURRENT pipeline experience, certain rule-of-thumb cost estimates have been selected. They cover some of the principal items of materials, equipment, installation, maintenance, and operation. Such factors—with allowances for local conditions—are used as guides in preparing estimates for some petroleum pipeline projects.

Stations

Electric-centrifugal, push-button controls, without tanks but with tank lines	$150/hp. plus $50,000
Diesel (gas) centrifugal semipush-button without tanks but with tank lines	$225/hp. plus $80,000

Stations (Method No. 2)

Horsepower	Electric	Diesel
300-500	$250/hp.	$360/hp.
500-750	180/hp.	260/hp.
750-1,000	150/hp.	215/hp.
1,000-1,500	125/hp.	180/hp.
1,500-2,500	100/hp.	145/hp.
Above 2,500	90/hp.	130/hp.

Tanks ..... $2/bbl. capacity

Line pipe

New pipe (f.o.b. mill) (8-in., 28-lb. is the cheapest pipe per ton) $175-185/ton

New pipe prices (X-46 to 20-in., X-52 above)

O.d. (in.)	Wall thickness (in.)	$/foot	O.d. (in.)	Wall thickness (in.)	$/foot	O.d. (in.)	Wall thickness (in.)	$/foot
4½	0.188	0.8492	14	0.281	4.0582	24	0.344	8.2677
6⅝	0.188	1.2896	16	0.312	5.0731	26	0.344	8.8924
8⅝	0.250	2.1017	18	0.312	5.7525	30	0.344	10.3904
10¾	0.250	2.7020	20	0.312	6.9396	36	0.375	13.4004
12¾	0.250	3.3466	22	0.344	7.6916			

Good second-hand pipe	70% of new
Poor but usable second-hand pipe	40% of new
Junk pipe	$40/ton

Buildings (ICC Account No. 106-156)

Pump and engine house with office (large) asbestos or steel on steel frame	$16.50/sq. ft. or $0.65/cu. ft. or $30/hp.
Pump and engine house (small), asbestos or steel frame	$6/sq. ft. or $0.45/cu. ft. or $22.50/hp.
Small office—frame or steel	$11/sq. ft. or $1.10/cu. ft.
Combination pump and engine house (small) steel frame	$8/sq ft. or $0.50/cu. ft. or $16.50/hp.

Foundation

Excavating, framing, pouring and concrete	$120/yd.
Floors (4-in.)	$0.55/sq. ft., 6-in. $0.80/sq. ft.
Walks (4-in.)	$0.35/sq. ft.
Concrete roads (4-in.)	$0.35/sq. ft., 6-in. $0.50/sq. ft.
Pumping unit—platform on piling	$5,500 each or $12/sq. ft.

Pumping equipment

Field units, in place	$120/hp.
Large engines with centrifugal pumps	$120/hp.
(Foundations and installation for above)	20% of cost of unit
Large motors with centrifugal pumps	$35-40/hp.
(Foundations and installation for above)	$2/hp.
Couplings for centrifugal pumps	25% of cost of pump
Speed increasers	10% of cost of engine
Heat exchangers	10% of cost of engine
Foundation and installation	20% of cost of unit

(Continued on next page)

PIPELINE COSTS

Other station equipment

(Unless the station has a lot of control equipment, this usually does not contain much investment)

For gathering units (total account) ..... $15/hp.

For trunk stations—control equipment can vary from ..... $90/hp. for push-button station to $45/hp. semipush-button station to $10/hp. for station with practically no control equipment

Oil tanks

Tank construction costs—floating roofs	Single tanks	Several tanks
Tank material and erection including coating and painting	$2.30/bbl.	$1.84/bbl.
Foundation including pad and ring wall and fire wall	0.08/bbl.	0.04/bbl.
Appurtenances	0.08/bbl.	0.07/bbl.
Installation and testing	0.08/bbl.	0.05/bbl.
Total	$2.54/bbl.	$2.00/bbl.

Communications

Base radio station installed with tower ..... $5,000 each

Portable radio, automobile or boat ..... $950 each

Two-wire pole line $9/mile

Microwave system $1,200/mile

Repairs of pipelines

For new lines $25/mile/year

Lines 10 years or so old, good terrain $50/mile/year

Medium marsh or swamp area $150/mile/year

Bad marsh or swamp area $200-500/mile/year

Repairs of building

For gathering-line service—4% of investment in ICC Account No. 106.

For trunk-line service—6% of investment in ICC Account No. 156.

Repairs of pumping stations

	Cents per hp.-hr.	$/installed hp. load factor 25%	50%	75%
Large stations				
Gas fuel				
Heavy-duty	0.20	4.40	8.75	13.15
High-speed	0.45	10.88	20.00	30.00
Electric	0.06	2.50	2.50	2.50
Small stations and gathering-line units				
Gulf Coast	1.50	33.50	65.00	100.00
Other	1.20	26.50	53.50	80.00

Repairs of oil tanks

1 cent/bbl. of capacity/year

Repairs of radio units ..... $75 each/year

Operation of pumping stations

Fuel or power

(Most field units are operated on natural gas, usually billed on basis of installed horsepower and hours operated)

Natural-gas stations ..... 0.5 cents/BHPH

Gas-diesel stations ..... 0.5 cents/BHPH

Diesel stations ..... 0.65 cents/BHPH

Crude stations ..... 0.65 cents/BHPH

Electrical stations ..... 0.8 cents/BHPH

Lube costs ..... 0.1 cent/BHPH for engines

Other pump-station operating costs

Electric stations ..... 10% of fuel costs

Other trunk stations ..... 30% of fuel costs

Gathering stations ..... 2% of fuel costs

Oil shortage—accidents

Normally a new facility will have little or no shortage. An average over a long period might be 1 to 2% of the total transportation cost.

GAS LINES

Construction costs depend on where and when

. . . as shown by these project estimates

IF THESE TABLES prove anything, it is that there are no average or typical construction costs.

They literally vary all over the map. Estimates filed with the Federal Power Commission present a revealing picture of the variable nature of construction costs. They do not attempt to show actual costs for a given diameter of line in a given area. They are valid only for a particular project under the conditions existing at that time.

This point is made clear by the great disparity in costs shown for the same diameter and for the same gen-

TABLE 1—COST BREAKDOWN FOR NEW TEXAS-CALIFORNIA GAS LINE
(Data: Estimate filed with FPC)

	Cost	% / total
Pipelines		
Main line	$73,750,000	38.47
Lateral systems	43,490,000	22.69
Compressor stations		
Main line	18,085,000	9.44
Lateral systems	3,142,000	1.64
Gathering systems		
West Texas	1,833,000	0.96
Panhandle	6,500,000	3.39
Measuring and analysis stations	317,000	0.17
Gas processing plants	8,000,000	4.17
Headquarters, shops, and garages	2,281,000	1.19
Employe housing	2,816,000	1.47
Communications facilities	311,000	0.16
Tools and work equipment	810,000	0.42
Office equipment	280,000	0.15
Transportation equipment	729,000	0.38
Cathodic protection	221,000	0.17
Office building	1,000,000	0.52
Land in fee	202,000	0.10
Total direct costs	$163,767,000	85.43
Undistributed construction costs	27,931,000	14.57
Grand total	$191,698,000	100.00

COST SUMMARY FOR 670-MILE 30-IN. MAIN LINE
(Roswell, N. M.-Topock, Ariz.)

Material	$52,378,000
Installation	19,583,000
Right-of-way	293,000
Damages	237,000
River crossings	1,259,000
Total	$73,750,000
Cost/inch-mile	$3,669

TABLE 2—COST BREAKDOWN FOR WESTERN CANADA GAS LINE
(Data: Estimate filed with FPC)

	Cost	% / total
Pipelines		
Main line	$78,840,431	55.52
Gathering line	15,547,555	10.95
Compressor stations	12,060,000	8.49
Measuring and regulating stations	301,516	0.21
Miscellaneous property	1,100,000	0.76
Housing equity	240,000	0.17
Communications	1,225,000	0.86
Land in fee	46,500	0.03
Canadian duties and sales taxes	6,126,000	4.31
Management of engineering and installation	8,075,000	5.68
Corporate and organization management (including contract consulting costs)	4,000,000	2.86
Omissions and contingencies	5,737,998	4.04
Interest during construction	7,700,000	5.42
Working capital	1,000,000	0.70
Total	$142,000,000	100.00

COST SUMMARY FOR 650-MILE 30-IN. MAIN LINE IN BRITISH COLUMBIA

Material	$41,714,031
Installation	36,411,400
Right of way and damages	715,000
Total	$78,840,431
Cost/inch-mile	4,043

eral area for the same year. It is possible for a loop to be laid on the same right-of-way at a lower cost than the original line laid 5 years earlier. This has happened. The availability of contractors and materials, and the time schedule and weather may affect the total cost enough to permit such an anomaly.

The figures presented here, while not offered as a guide for estimating, do indicate what an engineer might expect in areas where he has had no experience. They may provide an interesting check of his own costs in a familiar area. And they show how different conditions affect costs.

Southwest Gas Line

Table 1 breaks out the major cost components of a proposed gas line to run from Texas to California. The estimates reflect a system of the most modern design in regard to the use of high-strength pipe and automatic controls for compressor stations. The lateral systems represent an unusually large share of the total cost because of the location of supply.

The cost of the main line is further broken down to show the relation that different components bear to the total. Laying costs are given for terrain which varies from good going in the flat plains country to rough going of rocky hills.

Basis for the installation estimate is Table 3, which shows all major operations individually and indicates the magnitude of the investment required for the total big-inch spread. Less-favorable laying conditions in Arizona show up in the 15% higher estimate for that state.

Western Canada Gas Line

Similar analysis is applied to a recently constructed 30-in. gas line in British Columbia (Table 2). The lines are about the same length and have very nearly the same total cost. But the effect of difference in terrain is very evident in the main-line breakdown. Laying costs across the Canadian Rockies were almost double the Southwest estimates.

Material costs for the Southwest line are higher because they show the effects of 2 years of inflation and are for a 20-mile-longer line. But installation still boosts the cost per inch mile of the Canadian line 9% above the Southwest line.

South Louisiana Swamp Line

One of the most active areas of construction in the country is represented by the 20-in. line laid in the South Louisiana timbered swamp in 1958 (Table 4). It offers a sharp contrast to conditions and costs of the

TABLE 3—COST PER WEEK TO OPERATE ONE 30-IN. CONSTRUCTION SPREAD

	New Mexico	Arizona
Clear and grade	$25,081	$30,640
Unload, haul, and string	13,317	15,176
Ditch	43,429	49,605
Bend	6,518	7,290
Welding	38,462	43,608
Coating	20,350	23,845
Lowering in	16,552	18,743
Backfill	7,088	8,432
Cleanup	18,160	21,448
Utility	16,806	18,967
Office	9,016	9,408
Total	$214,779	$247,162

TABLE 4—COST BREAKDOWN FOR 46-MILE 20-IN. GAS LINE IN SOUTH LOUISIANA SWAMP
(Data: Estimate filed with FPC)

	Installation	Material	Total
Land and land rights			
Right-of-way	$44,160		$44,160
Damages	73,600		73,600
Survey and mapping	46,000		46,000
Contingencies	8,190		8,190
Total	$171,950		$171,950
Pipeline			
Line pipe	$2,068,550	$1,737,150	$3,805,700
Crossing pipe	103,000	34,530	137,530
Heavy-wall pipe	8,000	17,970	25,970
Mill inspection		4,420	4,420
Freight on pipe		53,100	53,100
Casing	18,000	3,560	21,560
Freight on casing		670	670
Pipeline primer		3,070	3,070
Pipeline enamel	67,800	74,030	141,830
Pipeline wrapper		39,240	39,240
Concrete coating	734,340		734,340
Freight on protective material		29,600	29,600
Line gate valve settings	32,000	72,000	104,000
Tap valve settings	8,000	12,000	20,000
Platforms	12,000	9,000	21,000
Cased crossings		3,000	3,000
Pip traps	18,000	50,000	68,000
Canal plugs	75,000	45,000	120,000
Canal signs	10,000	7,000	17,000
Cathodic protection	3,000	12,000	15,000
Miscellaneous	15,000	15,000	30,000
Radiographic inspection	18,400		18,400
Contingencies	95,730	44,450	140,180
Total	$3,286,820	$2,266,790	$5,553,610
General construction cost			
Engineering	$57,260		$57,260
Inspection	69,000		69,000
Cleaning and testing	9,200		9,200
Slack chain and final mapping	11,500		11,500
Contingencies	7,350		7,350
Total	$154,310		$154,310
Total direct cost	$3,613,080	$2,266,790	$5,879,870
Overhead expenses	58,800		58,800
Interest	89,100		89,100
Engineering fees	36,200		36,200
Total estimated cost	$3,797,180	$2,266,790	$6,063,970
Cost/inch-mile	$4,127	$2,464	$6,591

TABLE 5—COST BREAKDOWN FOR 350-MILE 30-IN. GAS LINE IN MIDWEST
(Data: Estimate filed with FPC)

	Material	Installation	Total
Right-of-way and damages	.....	.....	$1,570,240
Preliminary survey	.....	.....	245,350
Material and installation			
Main-line pipe	$21,733,020	$11,163,702	$32,896,722
Coating material			
Primer	35,050	.....	35,050
Enamel	592,345	.....	592,345
Wrapper	349,625	.....	349,625
Valves, drips	331,100	83,000	414,100
Highway and railroad crossings	261,200	770,000	1,031,200
Weights	34,160	.....	34,160
River crossings			
Ohio	108,000	440,000	548,000
Wabash	30,000	80,000	110,000
White	22,500	60,000	82,500
Green	20,100	53,600	73,700
Kankakee	30,000	80,000	110,000
Des Plaines	33,000	88,000	121,000
Miscellaneous material (2% of detailed cost)	471,602	.....	471,602
Field engineering and insp.	.....	911,300	911,300
Total	$24,051,702	$13,729,602	$39,596,894
General overhead (7% of direct cost—2.7% adm. and gen. overhead, 2.3% engr. and super., and 2% interest during construction)	.....	.....	2,771,783
Total	.....	.....	$42,368,677
Contingencies (about 5%)	.....	.....	2,118,323
Total cost of project	.....	.....	$44,487,000
Cost/inch-mile	.....	.....	$4,237

TABLE 6—COST BREAKDOWN FOR 395-MILE 34-IN. LINE IN UTAH AND NEVADA

	Material	Installation	Total
Pipe	$28,030,800	.....	$28,030,800
Freight on pipe	5,854,680	.....	5,854,680
Right-of-way	152,000	$30,700	182,700
Survey	16,600	13,000	29,600
Damages	157,000	25,700	182,700
Clear right-of-way	468,000	260,040	728,040
Unload, haul, and string	1,095,100	280,080	1,375,180
Bending	100,520	212,000	312,520
Line up and weld	456,000	1,000,080	1,456,080
Ditching (30% solid rock)	2,100,000	1,606,870	3,706,870
Clean, prime, paint, and wrap	1,400,000	764,000	2,164,000
Lower in	130,000	161,610	291,610
Backfill and clean up	220,000	300,880	520,880
Highway and railroad crossings	55,000	40,100	95,100
Moving men and equipment in and out	336,000	80,980	416,980
Test, purge, and pack	100,000	46,000	146,000
Valve assemblies	587,000	130,400	717,400
Accessory equipment	113,000	33,000	146,000
Other field costs	1,030,000	359,460	1,389,460
Total direct cost	$42,401,700	$5,344,900	$47,746,600
Cost/inch-mile	.....	.....	$3,555

Southwest plains and Canadian Rockies which have just been examined.

A more detailed breakdown is made for this project for two reasons. Abnormal conditions, with costs to match, are encountered here. And more gas pipelines are having to face these conditions as they seek to tap one of the continent's most important gas reserves.

The unit cost for installation alone on this project is more than the unit cost of all components combined on the Canadian line. This type of swamp construction involves clearing timber, digging a canal for a lay barge, weight coating, and taking extra precautions to make a permanent installation because of the high cost of repairs.

Costs in this area, too, vary widely. The one fact which you can depend on is that construction in this watery wilderness will be expensive—about the most expensive in the country except for offshore.

Lines laid off the Louisiana coast in the Gulf of Mexico have been the most expensive of all. Estimating in this region is proportionately hazardous because of lack of experience, weather, and other uncertainties. Unit costs for lines laid under similar conditions may be quite different.

Estimates for several projects filed with FPC range from roughly $6,900 per inch-mile to $9,500 per inch-mile. Unit costs on the larger diameters tend to be lower, as would be expected.

Midwest and Far West Lines

Costs in the hills and congested areas of the Midwest may be as high as they are in the Rocky Mountains. (See Table 5.) This is indicated by estimates for a line through Tennessee, Kentucky, Indiana, and Illinois, whose costs are comparable to the Canadian line in Table 2.

The cost summary for the 34-in. line in Utah and Nevada (Table 6) discloses estimates which are very close to the 30-in. line analyzed in Table 1. In comparing the various projects it should be noted that methods of allocating costs and items included may vary. Different companies have different ways of handling indirect costs particularly.

The detailed tables presented here represent a great variety of conditions and hence show unusual costs in some instances. They are not selected as typical but rather as indicative of the wide range of costs encountered. They don't tell you how much it will cost to build your pipeline. They do tell you, however, what the estimates have been for specific projects and how some companies approach the important job of cost estimating.

Compressor-station costs also vary widely

COMPRESSOR STATIONS, like pipelines, show wide variations in construction costs.

The cost components for a compressor station are broken out in Table 1. This is an estimate for a station located in Tennessee. Costs estimated for installation are higher than normal as compared with other estimates of this type. This seems to account for the above-average cost of $424 per installed horsepower. This figure includes $48 per horsepower for land, general overhead, and contingencies which are not listed separately in the totals of the table. The unit costs for this station would of course be lowered by expansion.

Costs for recent installations in several states are shown in Table 2, which is based on statements filed with FPC after projects have been completed. They show the range of costs and the relative importance of the major components. They are not meant as a guide to actual costs for a particular size station in a certain location.

For example, one of the most expensive stations reported to FPC was located offshore from Louisiana, where the most expensive pipeline construction is found. With costly structures required, the South Louisiana marsh and the gulf are generally the highest cost areas.

A station in Pennsylvania was built for $760 per horsepower, more than double the average cost which is usually close to $300. The explanation in this case was extreme difficulty in obtaining a site, a rush schedule, and material problems. This installation compares with $648 reported for an offshore station.

TABLE 1—COST BREAKDOWN FOR COMPRESSOR STATION
(Six 1,100-hp. vertical gas engines)

	Material	Installation	Total
Land	.....	.....	$6,000
Gas engines	$792,000	$37,800	829,800
Jacket-water pump, piping and accessories	9,140	2,320	11,460
Switchboards and power wiring	13,780	3,640	17,420
Air compressor with piping	10,580	1,360	11,940
Dual meter run	10,420	2,615	13,035
Gas scrubbers and accessories	79,080	9,440	88,520
Scrubber-oil storage tank and accessories	7,255	1,495	8,750
Lube-oil storage tank and accessories	2,195	655	2,850
Air receiver and accessories	4,780	1,780	6,560
Jacket water surge tank and accessories	2,625	1,075	3,700
Water coolers (atmospheric, jacket water) and accessories	104,640	18,600	123,240
Gas aftercooler (atmospheric type with accessories)	59,220	8,400	67,620
Compressor building bay for vertical engines, complete	78,260	88,200	166,460
Meter building	5,775	6,200	11,975
Shop and office building	51,685	25,150	76,835
Residence and 1-car garage (four)	42,000	54,600	96,600
Misc. costs per engine for plant piping, controls, comm., etc.	201,600	144,900	346,500
Contractor's fee (10% labor)	.....	63,680	63,680
Misc. costs for new building	80,220	105,250	185,470
Field engr. and insp.	.....	47,400	47,400
General overhead	.....	.....	174,360
Contingencies (5%)	.....	.....	133,785
Total cost of project	$1,736,935	$747,920	$2,799,000
cost per horsepower	263	113	424

TABLE 2—COMPRESSOR-STATION CONSTRUCTION COSTS IN DOLLARS

State	Cap. hp.	Land and improve.	Struc. and equip.	Misc. and const.	Total	Per hp.	Year built	New station or addition
Arizona	10,000	130,723	2,552,952	408,960	3,092,635	309	1957-8	New
Arizona	8,000	101,385	1,847,851	372,061	2,321,297	290	1957-8	New
Arizona	8,000	58,086	1,704,506	361,782	2,124,374	266	1957-8	New
Total	26,000	290,194	6,105,309	1,142,803	7,538,306	290		
$ per hp.		11	235	44	290			
Colorado	440	62	126,568	6,661	133,291	303	1958	New
Colorado	2,000	.....	619,012	70,730	689,742	345	1957-8	Addition
Total	2,440	62	745,580	77,391	823,033	337		
$ per hp.		.....	305	32	337			
Indiana	12,000	200,356	3,137,000	175,000	3,512,356	293	1957-8	New
$ per hp.		17	261	15	293			
Kansas	2,000	5,058	453,276	14,555	472,889	236	1958	Addition
Kansas	2,000	2,060	546,616	15,168	563,844	282	1958	Addition
Kansas	2,000	3,573	493,100	15,057	511,730	256	1958	Addition
Total	6,000	10,691	1,492,992	44,780	1,548,463	258		
$ per hp.		2	249	7	258			

PIPELINE COSTS

State	Cap. hp.	Land and improve.	Struc. and equip.	Misc. and const.	Total	Per hp.	Year built	New station or addition
Louisiana	2,500	....	417,490	21,580	439,070	176	1958	New
Louisiana	1,320	2,787	349,851	3,603	356,241	270	1958	New
Louisiana	1,320	....	289,238	53,412	342,650	260	1958	New
Louisiana	5,280	25,637	1,733,368	175,979	1,934,984	366	1957-8	New
Louisiana	1,320	1,536	755,754	97,996	855,286	648	1957-8	New
Louisiana	2,000	21,755	490,228	23,707	535,690	268	1956-7	Addition
Total	13,740	51,715	4,035,929	376,277	4,463,921	325		
$ per hp.		4	294	27	325			
Mississippi	2,000	3,000	363,174	36,000	402,174	201	1957-8	Addition
Mississippi	5,000	14,227	1,529,982	81,767	1,625,976	325	1956-7	Addition
Total	7,000	17,227	1,893,156	117,767	2,028,150	290		
$ per hp.		3	270	17	290			
Nebraska	4,000	3,992	1,092,562	36,723	1,133,277	283	1958	Addition
Nebraska	1,320	3,885	318,063	9,359	331,307	251	1958	Addition
Total	5,320	7,877	1,410,625	46,082	1,464,584	275		
$ per hp.		1	265	9	275			
New Jersey	4,100	....	1,665,651	417,391	2,083,042	508	1958	New
$ per hp.			406	102	508			
New Mexico	10,800	155,813	2,747,270	533,678	3,436,761	322	1957-8	New
New Mexico	6,000	23,915	1,290,833	207,124	1,521,922	254	1957-8	New
New Mexico	5,000	36,538	1,516,134	290,575	1,843,147	369	1957-8	New
New Mexico	5,000	128,152	1,552,799	310,539	1,991,490	398	1957-8	New
Total	26,800	344,418	7,107,086	1,341,916	8,793,320	328		
$ per hp.		13	265	50	328			
Ohio	3,300	2,172	1,280,907	66,915	1,349,994	409	1958	
Ohio	12,000	120,000	2,918,747	167,000	3,205,747	267	1957-8	
Total	15,300	122,172	4,199,654	233,915	4,555,741	298		
$ per hp.		8	275	15	298			
Oklahoma	4,000	3,252	936,242	27,723	967,217	242	1958	Addition
$ per hp.		1	234	7	242			
Pennsylvania	5,000	....	1,031,005	327,092	1,358,097	272	1958	New
Pennsylvania	5,000	....	997,128	352,420	1,349,548	270	1958	New
Pennsylvania	2,000	....	371,705	5,978	377,683	189	1957-8	Addition
Total	12,000	....	2,399,838	685,490	3,085,328	257		
$ per hp.			200	57	257			
Tennessee	2,000	3,000	312,503	32,000	347,503	174	1957-8	New
$ per hp.		2	156	16	174			
Texas	2,700	16,803	633,594	136,087	786,484	291	1957-8	New
Texas	500	8,054	151,087	30,001	189,142	378	1958	New
Texas	750	702	172,845	7,452	180,999	241	1958	New
Texas	600	310	91,310	.....	91,620	153	1958	New
Texas	225	....	43,501	.....	43,501	193	1958	New
Texas	6,600	.....	1,846,184	386,254	2,232,438	338	1957-8	New
Texas	6,000	22,871	1,926,184	24,565	1,973,620	329	1957	New
Texas	2,000	12,583	842,218	223,078	1,077,879	539	1958	New
Texas	1,350	457	327,047	4,911	332,415	246	1958	Addition
Texas	2,200	....	512,833	203,258	716,091	325	1958	Addition
Texas	2,000	4,023	417,297	14,430	435,750	218	1958	Addition
Texas	2,640	7,951	1,173,972	319,728	1,501,651	569	1957-8	Addition
Texas	880	....	147,418	32,237	179,655	204	1957-8	Addition
Total	28,445	73,754	8,285,490	1,382,001	9,741,245	343		
$ per hp.		3	291	49	343			
West Virginia	2,000	....	498,781	54,700	553,481	277	1957-8	Addition
West Virginia	2,000	....	547,963	30,831	578,794	290	1957-8	Addition
West Virginia	2,000	....	757,547	76,500	834,047	417	1957-8	Addition
West Virginia	2,000	....	568,505	54,870	623,375	312	1957-8	Addition
West Virginia	880	....	306,015	21,853	327,868	302	1957-8	Addition
Total	8,880	....	2,678,811	238,754	2,917,565	328		
$ per hp.			301	27	328			
Wyoming	440	....	135,480	21,756	157,236	357	1958	New
Wyoming	1,320	....	380,154	47,154	427,308	324	1957-8	Addition
Total	1,760	....	515,634	68,910	584,544	332		
$ per hp.			293	39	332			

Labor rises 23-29%; major equipment

TABLE 1—AVERAGE LABOR COST—15 STATES

	1954	1959	% increase
Common laborers	$1.63	$2.10	29
Welders	2.96	3.71	25
Principal operators	2.75	3.37	23

AVERAGE LABOR COST—CANADA

	1954	1959	% increase
Welders	$2.80	$3.55	27
Principal operators	2.36	2.66	13

Source: Pipe Line Contractors Association.

Both are in line with national trends in other industries

TABLE 2—LABOR COSTS BY STATES

Classification	1954	1959	% increase
NEW YORK			
Common laborers	$1.96	$2.68	37
Welders	3.10	3.90	26
Principal operators	2.93	3.91	33
PENNSYLVANIA			
Common laborers	1.78	2.32	30
Welders	3.10	3.80	23
Principal operators	2.82	3.50	24
WEST VIRGINIA			
Common laborers	1.44	1.86	29
Welders	2.90	3.60	24
Principal operators	2.64	3.01	14
KENTUCKY			
Common laborers	1.29	1.58	22
Welders	2.90	3.60	24
Principal operators	3.01	3.49	16
LOUISIANA			
Common laborers	1.11	1.45	31
Welders	2.85	3.60	26
Principal operators	2.40	2.80	17
ALABAMA			
Common laborers	1.11	1.32	19
Welders	2.80	3.55	27
Principal operators	2.40	2.75	15
ILLINOIS			
Common laborers	2.07	2.65	28
Welders	3.10	3.90	26
Principal operators	2.98	3.65	22
OHIO			
Common laborers	1.85	2.40	30
Welders	3.10	3.80	23
Principal operators	3.12	3.74	20
MICHIGAN			
Common laborers	$1.57	$2.17	38
Welders	3.00	3.80	27
Principal operators	2.93	3.49	19
KANSAS			
Common laborers	1.38	1.52	10
Welders	2.85	3.60	26
Principal operators	2.40	2.77	15
NEW MEXICO			
Common laborers	1.50	1.80	20
Welders	2.80	3.55	27
Principal operators	2.58	2.85	10
ARIZONA			
Common laborers	1.97½	2.61½	32
Welders	2.80	3.55	27
Principal operators	2.70	3.60	33
TEXAS			
Common laborers	1.17	1.40	20
Welders	2.85	3.60	26
Principal operators	2.40	2.75	15
CALIFORNIA			
Common laborers	2.07½	2.96½	43
Welders	3.22½	4.00	24
Principal operators	3.00	4.58	53
WASHINGTON			
Common laborers	2.19	2.82	29
Welders	2.07½	3.87	26
Principal operators	2.96	3.68	24
CANADA			
BRITISH COLUMBIA			
Common laborers	$1.20		
Welders	2.80	3.55	27
Principal operators	2.40	2.93	22
ALBERTA			
Common laborers	$1.20		
Welders	2.80	3.55	27
Principal operators	2.35	2.60	11
SASKATCHEWAN			
Common laborers	$1.00		
Welders	2.80	3.55	27
Principal operators	2.35	2.60	11
ONTARIO			
Common laborers	$1.00		
Welders	2.80	3.55	27
Principal operators	2.35	2.75	17
MANITOBA			
Common laborers	$1.00		
Welders	2.80	3.55	27
Principal operators	2.35	2.40	2

up 30.9%

THE WAGE RATES for pipeline contract labor have followed the national pattern upwards.

To show the trend, rates are reported for common laborers, welders, and principal operators. Proportionate increases have been given to other operators, truck drivers, welder helpers, and skilled labor.

The 15 representative states give an accurate picture of the nationwide pipeline-construction-labor situation. All sections of the country are represented. In determining the wage rate for a particular state, the rates in the various zones of the state are averaged giving weight to the number of counties in each zone.

The rates negotiated by various highway contractors' groups with unions throughout the country provide the basis for negotiating pipeline wages for workmen other than welders. The high level of highway building has exerted a strong upward pressure on wages in that industry and also in pipeline construction.

Wages negotiated by the Pipe Line Contractors Association have irresistibly followed the pattern of highway construction. Still, the average wage in general construction is above pipeline construction ($2.50 an hour for common labor, $3.79 for skilled labor).

Moreover, the association, in the National Pipeline Agreements, has been able to retain for contractors working conditions and customs which are peculiar to the pipeline-construction industry. And these have a value which cannot be measured in cents per hour.

Construction Equipment

There is a variety of trends in construction equipment. The major equipment has gone up an average of 30.9% since 1954. No comparisons were made in the table because numerous equipment modifications have resulted in many cases in a new piece of machinery which is not comparable to its predecessor.

In special pipeline-construction equipment, sale prices and rentals have not increased at all in some instances; in others they have increased up to 50% in isolated cases. Generally this type of equipment has increased 20% or less.

TABLE 3—SPECIAL PIPELINE CONSTRUCTION EQUIPMENT PRICES

	1954		1959	
	Rental	Sale	Rental	Sale
Bending machines				
6-20 in.			$ 850/month	$ 8,500
16-30 in.			1,475/month	14,750
22-36 in.			1,925/month	19,250
20 in.		$10,750		10,700
30 in.		11,750		13,700
36 in.		17,500		20,300
Internal line-up clamps				
Mechanical				
12 in.	.005/ft.	$ 650	.005/ft.	$ 725
36 in.	.005/ft.	1,600	.005/ft.	1,750
Hydraulic				
20 in.			.0075-01/ft.	1,425
Pneumatic				
20-26 in.			.015/ft.	
30-36 in.			.0175/ft.	
Dope kettles on tracks				
20 bbl.		$7,250		$8,725
30 bbl.		7,900		8,930
Cleaning and priming Machine				
24 in.	.0125/ft.	$6,650	.0125/ft.	$7,325
30 in.		8,730		10,335
Coating and wrapping machine				
24 in.	.015/ft.		.0225	
30 in.			.025	
Cradles				
16-26 in.		$550		$800
Double jointer			$10 per weld ($25,000 minimum)	$140,000

TABLE 4—MONTHLY RENTAL RATES FOR MAJOR CONSTRUCTION EQUIPMENT
(Source: Associated Equipment Distributors)

	1959
Wagon drills, wheel mounted (towed), medium	$283
Air compressor, portable, 211-250 c.f.m.	396
Clamshell bucket, 2 cu. yd.	279
Dragline bucket, 2 cu. yd.	312
Crane, clamshell, crawler mounted, diesel powered, 2 cu. yd.	3,464
Crane, clamshell, wheel or wagon mounted, diesel, 1 cu. yd.	2,960
Trenching machine, diesel, 6-ft. maximum depth, 36-in. width	2,374
Welding machine, gasoline, 250 amp.	100
250-350 amp.	129
Crawler tractor, gear drive, diesel, 96-115 drawbar hp.	1,344
Crawler tractor, torque converter drive, diesel	
145-164 net engine hp.	1,681
215-250 net engine hp.	3,062
251-330 net engine hp.	3,569
Backhoe mounted on crawler tractor of 56-74 hp.	802
Bulldozer attachment for mounting on crawler tractor, torque converter drive, net engine hp. of:	
145-164	328
215-230	465
251-330	497
Sideboom attachment (maximum capacity 4-ft. overhang)	
17,100-30,000 lb.	552
30,100-75,000 lb.	632
75,100 lb. and over	833

PIPELINE COSTS

Pipelines still cheapest overland transportation

THE BARGAIN of pipeline transportation is an old story in the oil industry.

One of the more effective means of dramatizing this fact is to compare pipeline rates with mail rates. You can ship a gallon of crude oil (weight 7.4 lb.) from New Mexico to Buffalo, N.Y., some 1,500 airline miles, for less than 1½ cents. You can ship a gallon of gasoline (weight 6.6 lb.) from Houston to Chicago, some 1,000 miles for the same rate. This is only three-eighths the cost of sending a 1-oz. letter through the U.S. mails.

Some of the more interesting products tariffs are listed separately and in detail in Table 3. They spotlight the effect of the war-built Little Big Inch, which was returned to products service last year after 10 years as a natural-gas carrier for Texas Eastern Transmission Corp. It is now cheaper to ship products from Beaumont or Baytown, Tex., to Chicago via the 20-in. line than it is to ship from Tulsa to Chicago via Great Lakes Pipe Line, which has the lowest Oklahoma-Chicago tariff.

TABLE 1—CRUDE-OIL PIPELINE RATES

	Cents per bbl.
From West Texas-New Mexico to:	
Beaumont	20
Houston	17-20
Rose Bluff, La.	21.5-25
Kansas City, Mo.	24-25
Wood River, Ill.	32
Chicago	35-40
Cincinnati	43
From North Texas to:	
Chicago	25-32
Beaumont	18-20
Houston	17-24
From Kansas to:	
Wood River, Ill.	22
From East Texas to:	
Beaumont	7.5-10
Toledo	21
From Oklahoma to:	
Wood River, Ill.	22
Chicago	25
From NW Wyoming to:	
Wood River, Ill.	34
Chicago	37
Toledo	47
Findlay	45.5
From Edmonton to:	
Anacortes, Wash.	42
St. Paul	44
Sarnia, Ont.	64
Toronto	72
From Kerrobert, Sask., to:	
St. Paul	38
Sarnia, Ont.	58
Toronto	66
From Four Corners to:	
Houston	50
Los Angeles	40
From NE Colo. & SW Neb. to:	
Wood River, Ill.	29
Chicago	32
Detroit	44
From SE Wyoming to:	
Kansas City, Mo.	24
Wood River, Ill.	32
Chicago	35-38

TABLE 2—PRODUCTS PIPELINE RATES

	Cents per bbl.
From Borger, Tex., to:	
Denver	35
Kansas City, Kans.	33
From Houston, to:	
Kansas City, Kans.	68
Baton Rouge	12
From Beaumont, to:	
Fort Worth	25
From Baton Rouge, to:	
Birmingham	20.4
Athens, Ga.	29
Greensboro, N.C.	29.8
From Kansas City, to:	
Wood River	25
Chicago	43
From Wood River, to:	
Chicago	25
Indianapolis	21
From Chicago, to:	
Detroit	22
Madison	24
From Tulsa, to:	
Kansas City, Kans.	28
Chicago	58
Madison	55
Superior, Wis.	64
From Linden, N.J., to:	
Pittsburgh	27
Syracuse	21.75
Rochester	31.75
From Philadelphia, to:	
Newark, N. J.	8
Syracuse	26
Cleveland	38
From Billings, Mont., to:	
Helena, Mont.	22
Spokane	55
From Salt Lake City, to:	
Boise, Idaho	37
Spokane	73
From Los Angeles, to:	
Phoenix, Ariz.	60
From El Paso, to:	
Phoenix, Ariz.	60

TABLE 3—PRODUCTS TRANSPORTATION RATES
(Gulf Coast—Chicago and Tulsa—Chicago)

GULF COAST TO CHICAGO AREA	Cents per bbl.					
	Motor Fuel			Distillate		
	Tariff	Terminal Charge	Total	Tariff	Terminal Charge	Total
Texas Eastern—Beaumont—W. Chicago	40	12.2	52.2	44	12.2	56.2
Texas Eastern—Baytown, Tex.—W. Chicago	41	12.2	53.2	45	12.2	57.2
Gulf Refining—Port Arthur—Helena, Ark.	20	4.6	24.6	20	3.4	23.4
Barge—Helena, Ark.—W. Chicago	24.4	12.2	36.6	28.1	12.2	40.3
Total	44.4	16.8	61.2	48.1	15.6	63.7
TULSA—CHICAGO AREA						
Okla. Miss. River—Tulsa-McRae, Ark., and Texas Eastern—McRae-W. Chicago	49	12.2	61.2	49	12.2	61.2
Okla. Miss. River—Tulsa—W. Memphis, Ark.	26.3	....	26.3	26.3	....	26.3
Barge—W. Memphis—W. Chicago	22.2	12.2	34.4	26	12.2	38.2
Total	48.5	12.2	60.7	52.3	12.2	64.5
Great Lakes—Tulsa—Chicago	58	2	60	58	2	60
Cherokee—Tulsa—Wood River, Ill.	33	....	33	33	....	33
Wabash—Wood River—Griffith, Ind.	22	8	30	22	8	30
Total	55	8	63	55	8	63

CROSE... equipment used throughout the world
Pipeline construction can be a dramatic meeting of the Old and the New . . . as remarkably demonstrated by Crose equipment on the job in many foreign lands. Rugged, dependable equipment furnished by Crose from numerous strategically located supply points, has established an international standard for speed, efficiency and economy within the world-wide pipeline construction industry.
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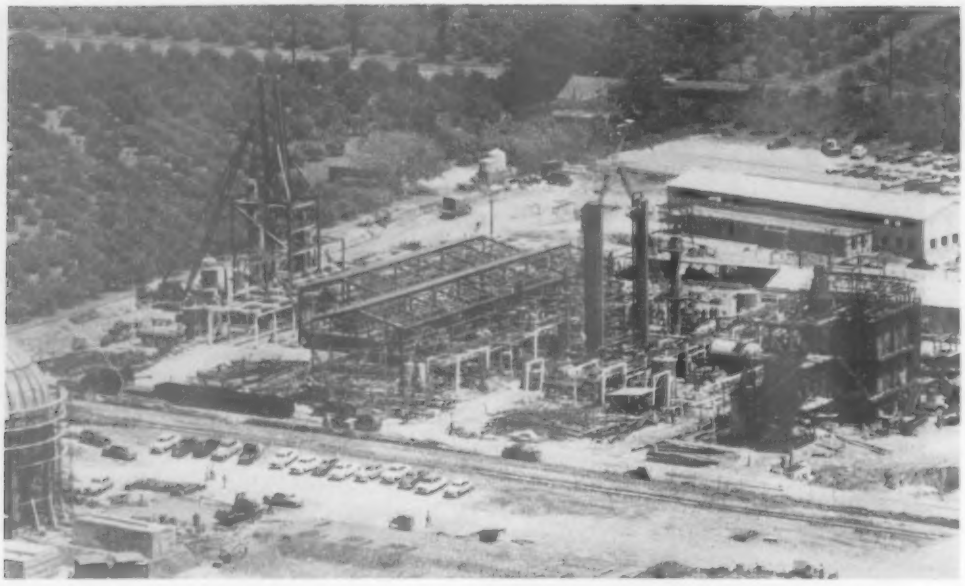


BACK IN 1953 the ammonia boom was on. This shows erection of Shell Chemical Corp.'s plant at Ventura, Calif. Synthetic nitrogen is today's largest-tonnage petrochemical, up to nearly 4 million tons per year at present, and is expected to resume its growth pattern in the future.

The decade ahead will likely witness some sharp changes in the chemical industry. Chemical-marketing research will play an important role in plant design as well as in . . .

BY H. E. WESSEL
Assistant Director, Market Development,
Stauffer Chemical Co., New York

Locating tomorrow's chemical plants

PAST SUPPLIERS to the chemical industry, such as the petroleum industry, and the past customers of the chemical industry, such as rubber producers, are entering the chemical-manufacturing field in a big way themselves. The chemical industry, as we knew it in the past, is not standing still either but is moving into the energy field at two levels, atomic energy and high-energy fuels, and may within the next two decades revolutionize the metallurgical industry.

Many of our customers in the future are not going to be the same people with whom we have dealt before, so that chemical-market researchers will have to study unfamiliar markets. The data which will be available for projecting these markets will be far too meager. Management, however, will not wait until competitors have established the pattern for us but will insist that market researchers stick out their necks and that plant designers build in some flexibility to meet the changing conditions which can be anticipated.

What Will Growth Be?

Now let us take a closer view—the next 10 years ahead. A composite of several relatively recent estimates of the sales and investment 10-year-growth projections for major subgroups of the chemical industry will be found in Table 1. Now that we have a broad picture of what types of plants will be built and the relative quantity of each group, let us look at how chemical-market research will be used to help design and locate them.

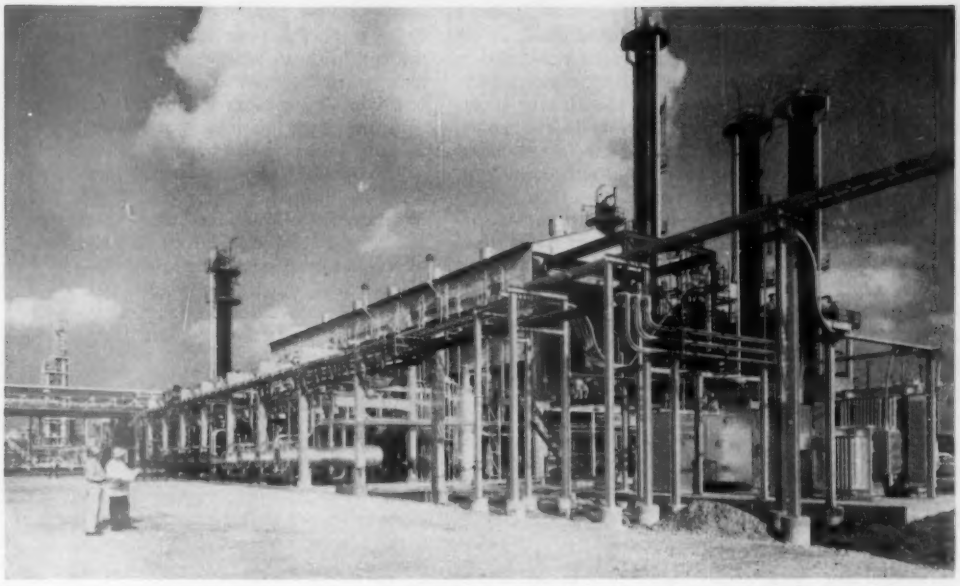
TABLE 1—PROJECTED INCREASE IN ANNUAL SALES, 1957-1967
(Data in millions of dollars)

Synthetic fibers	$2,000
Organic chemicals	1,600
Surface coatings, pigments, laminates	2,000
Plastics	1,500
Elastomers	600
Agricultural chemicals, including synthetic nitrogen, but not potash, ag phosphate, or mixed fertilizers	400
Industrial gases	200
Detergents and allied phosphates	200

Fertilizers

I will take a few widely divergent areas as examples of the influence chemical marketing research will have on chemical-plant design and location. First, let me take as an example the fertilizer industry. Normally, this industry is hardly accorded the name "chemical," yet it consumes most of the ammonia and nitric acid manufactured, half the phosphoric acid, more than 90% of all the potassium compounds produced, and one-third of the sulfuric acid made.

A "growth" industry . . . More than that, it is a true growth industry, in



THE GULF COAST—This is the compressor area for Jefferson Chemical Co.'s new ethylene unit at Port Neches, Tex. Some 80% of the U. S. petrochemical tonnage is now manufactured on the Gulf Coast. But profits can also be made at Wichita, Kans., and other locations. Many "interlarding" factors enter into selection of a plant location.

that the "chemical" content of mixed fertilizer and materials used for direct application has doubled in the last 10 years to a value exceeding 6 million tons annually. Even with that, this country is not yet replacing half the nutrients taken out of the soil by row crops. Pasture fertilization has hardly scratched the surface so far as the ultimate fertilizer potential is concerned, and the fertilization of timberland alone could more than double our total annual consumption.

Until only a few years ago, fertilizer selling literally was order taking and most of the industry is still geared to that type of operation. When production caught up with demand and profits quit climbing and even diminished 2 years ago, the industry's trade association conducted a customer-attitude survey which determined some surprising facts. The farmer did not know very much if anything about what fertilizer products would do for his profits except that "he probably should use more fertilizer."

A basic conclusion drawn from the survey was that the industry should promote soil analysis for the farmer, because this is the only sound basis for prescribing the quantity and ratio of basic ingredients for maximum results in terms of maximum return to the farmer per dollar spent. Results from pilot all-out publicity efforts to increase soil-testing in several southern counties have been spectacular.

Granular fertilizer . . . At the same time, the farmer is being offered a "premium" grade fertilizer in the form of granulated free-flowing products, and likes them. In the State of Ohio, granular-fertilizer sales jumped from almost 14% to 50% of the total in 3 years.

Most fertilizer plants do not have granulators, and since a minimum-sized unit costs as much as a smaller complete conventional plant, many never will have them. On the other hand, "prescription" mixing of fertilizer requires a considerably different type of plant from even the larger units of today. At least 50% of the replacement cost of an average-sized modern granular fertilizer plant will have to be added to adapt it to these new conditions.

Last of all, fertilizer manufacturers are experiencing the fact already that the average dealer is not effective enough to move the volume of products necessary to keep all this proposed backup capital at work anywhere near full time. The **big** dealer can buy granulated material for blending at very little above the delivered cost of the nongranular materials used by the conventional mixer. When a large dealer prescription mixes these granular materials, he can net more on his investment than the conventional fertilizer manufacturer selling through the standard channels, even after the blender reduces his price 10% to minimize farmer resistance to this new product. In parts of Illinois and Missouri where the biggest fertilizer producer in each case has promoted bulk blending, the sale of bulk blends already amounts to 50% of the total of blends plus mixtures.

In view of all these variables, the market researchers employed by fertilizer mixers and the basic fertilizer material producers are going to work overtime in the next few years to point the way to correct plant locations and design.

Synthetic Rubber

Now let us take a look at the synthetic-rubber industry. In 1956, the combined annual sales of elastomers by the top seven **chemical** companies amounted to only $60,000,000. An estimate of the increase in annual rate of sales during the period 1956-1965 is estimated at $600,000,000, a suitable-sized amount to be of interest. J. G. Park,[1] of Enjay Co., estimates the 1965 elastomer situation as shown in Table 2.

He further estimates that the production of natural rubber will not increase over the present level so that a market will exist for 300,000 long tons of butyl, polyisoprene, polyurethane, or some presently unknown type to fill the gap.

On the other hand, the U. S. mar-

TABLE 2—CONSUMPTION OF CERTAIN SYNTHETIC ELASTOMERS IN 1965
(Millions of long tons)

Type—	World	United States	United States gain or (loss) over 1956
Natural	2.20	0.600	0.04
GRS	1.845	1.007	0.25
Butyl	0.225	0.165	0.11
Neoprene	0.15	0.125	0.03
Nitrile	0.05	0.040	0.01
Total	4.47	1.937	0.44

ket for GRS will not grow enough to overtax the U. S. polymer facilities, nor the U. S. butadiene capacity (GRS weight yield about 138% on butadiene).

You can see that some chemical-company market researchers are going to lose some sleep over this area too.

Petrochemicals

According to Kuhn,[2] of Texaco, 80% of the petrochemical tonnage is now manufactured on the Gulf Coast. He predicts growth from 19 million to 42 million tons per year production in the decade ahead, with the latter figure 40% of total tons of chemicals produced.

Synthetic nitrogen . . . This, today's largest tonnage petrochemical, is up to nearly 4 million tons now, and is expected to resume its rapid growth pattern as soon as the current short-term overcapacity problem disappears. More than that, new reformer-based nitrogen plants are competitive with today's producers, so that even though refiner's demand for hydrogen is growing rapidly and the refiner is disturbed by the seasonality of the nitrogen market, refiners will build much of the new nitrogen capacity.

Gulf Coast vs. Iowa . . . Thirty-five per cent of domestic oil-refining capacity is on the Gulf Coast and another large portion in the Middle Atlantic States, some distance from the big Midwest market. Iowa's ultimate nitrogen market alone is one-fourth of the present U. S. capacity. This makes for problems in plant location for market researchers of oil companies considering nitrogen expansion.

Kuhn estimates the 1965 petrochemical production will be made about half and half from refinery byproducts and natural gas and associated liquids. He points out that 66% of the LPG used for chemical manufacture last year was used in Texas and Louisiana. He expects LPG production to grow by 90% and natural-gas production by 50% in the next decade.

It looks as though at least a few market researchers in each chemical company will be unscrambling these plant-location and design problems for their companies for some time to come.

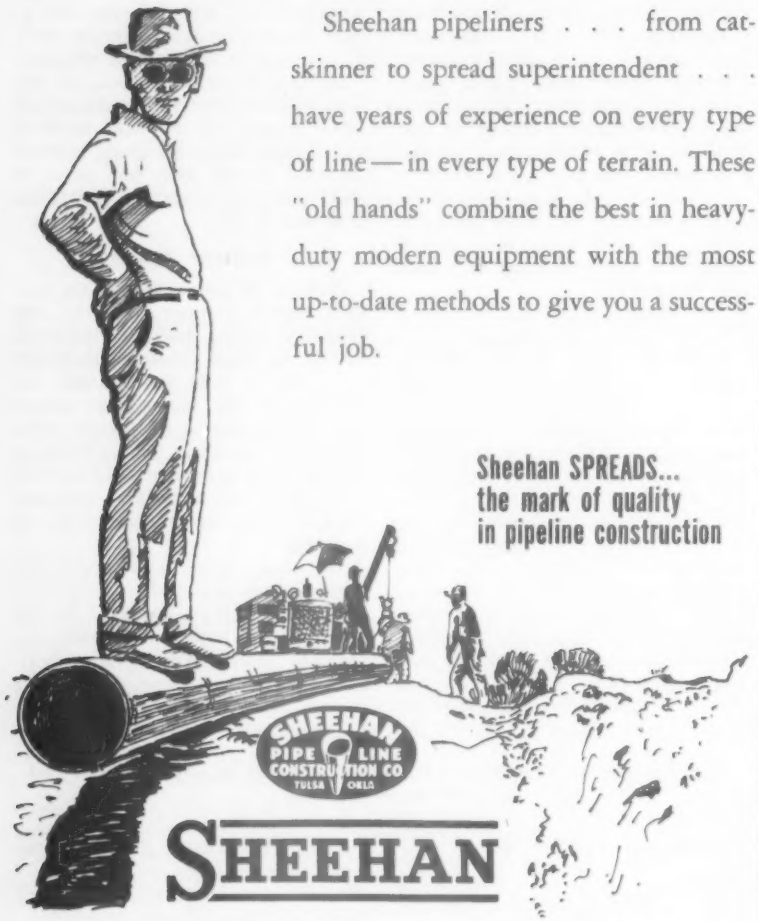
Plant location factors . . . Let me bring this discussion back into proper perspective so that you don't get the idea that the chemical-market researcher is the only man on the plant-location team. A Du Pont check list assigns 1,000 points total to the 100 or more factors which go into a plant-location decision and gives only about 100 points for the evaluation of the market situation. The compromise location (I doubt if there ever was an **ideal** one) must take into consideration the relative importance of raw-material availability at a reasonable price, transportation costs (inbound and outbound), labor availability, and all those things you will find listed in the Chemical Business Handbook. Anyway, most of the chemical-market researchers will be busy in the next few years hunting for new markets for surplus capacity.

Chemical complexes . . . Capital conservation may dictate a plant location, too. It did in the case of several ethylene users who could avoid an investment in cracking facilities by clustering around the Port Arthur production facility of a major oil company. The same thing happened to acetylene users at Calvert City, Ky., and Ashtabula, Ohio. Over-the-fence chlorine helped at the last two locations, also. Another chemical company recently built its first major plant away from home base to get over-the-fence low-cost materials. Low-cost water transportation has helped the Texas-Louisiana chemical complex, even though ultimate markets are a thousand miles away.

Wichita can compete, too . . . Gulf Coast chlorine capacity has grown be-

pipeliner . . .

. . . the "make-or-break" factor in pipelining



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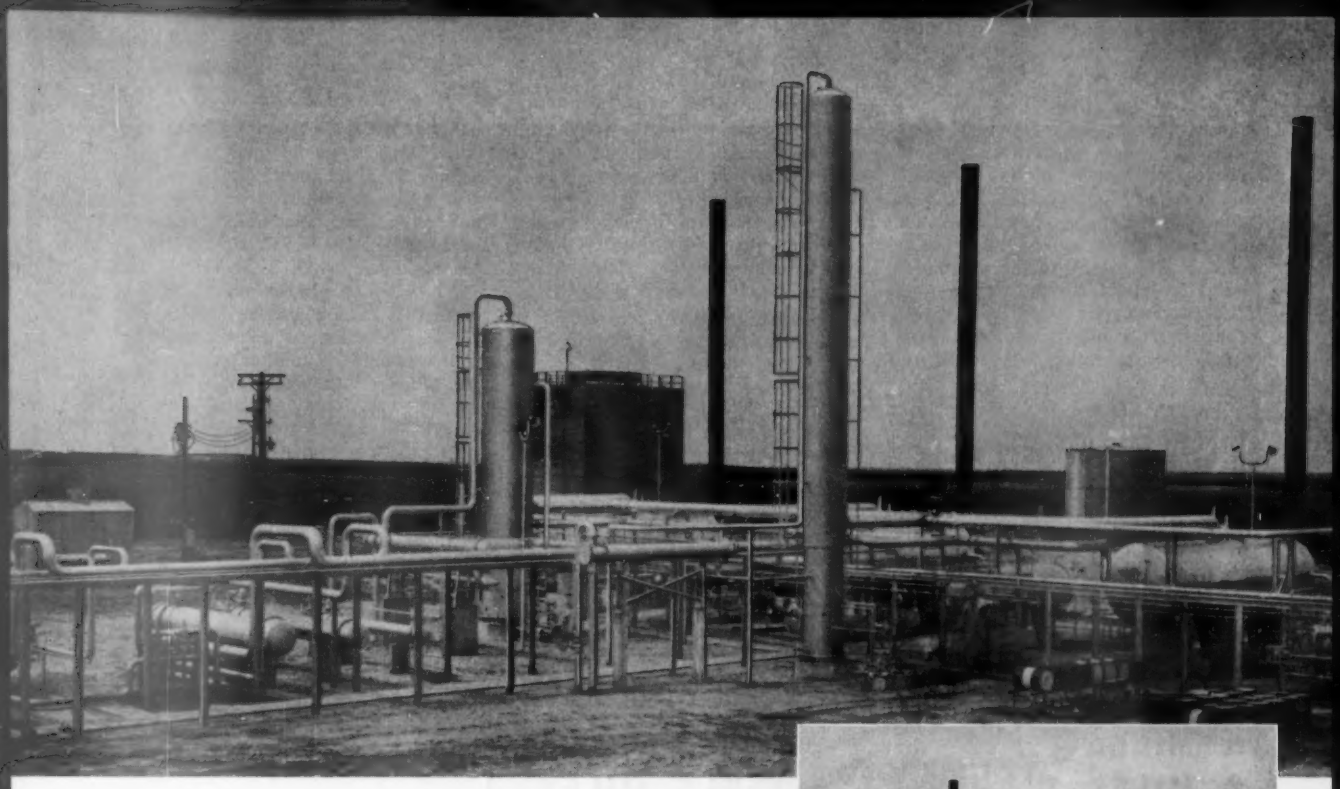

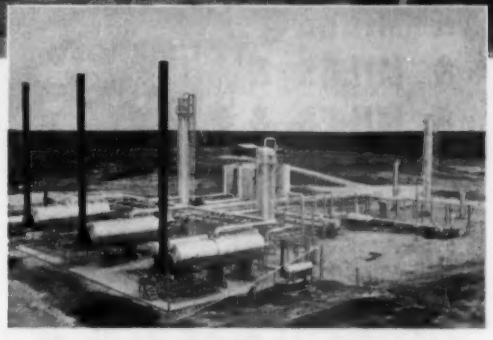

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cause chlorine is a low-cost "activator" of cheap hydrocarbons, plentiful there. Vinyl chloride contains about 57 wt. % chlorine, and a less-upgraded form of chlorine, carbon tetrachloride, is almost all chlorine (92%). Although a major production point for the latter is on the Gulf Coast, a new unit at Wichita, Kans., competes because it is much closer to a principal market, wheat-fumigant base.

Enough for the point that market proximity may appear to take a back seat in many plant-location studies.

Now a few remarks about overseas plant locations and markets. Whether you are a chemical-market researcher, who realizes by now that I haven't said anything new, or a production man, who has confirmation of his suspicions that market research is done with crystal balls—you would like a trip to Rio.

First, the areas where expansion in chemical plants are going on in a big way will give us a clue about current markets. Market potential exists in Europe in spite of tremendous expansion, since it now produces only 25% of world chemicals in contrast to 50% before World War II.

Western Europe alone built 1 billion dollars of new chemical plants in 1955 after a record-breaking 800 million the year before. Britain invested 1.4 billion in chemical and allied-industry plants in the period 1948-1953. These values are **big,** even by U. S. standards. In 1955, sales of plastics materials exceeded 1 million metric tons when U. S. production of the same materials was only 1.7 million metric tons. In the German Republic, the IG splinters are already effectively acting as a team and the government 5-year plan calls for a further 50% increase in chemical production.

Canada, with only a small population, has invested 600 million in chemical plants in the last decade, yet it still imports large quantities of intermediates, being the largest U. S. market for chemical exports.

Now for the **newer** overseas chemical markets. Brazil markets for certain classes of chemicals are estimated at 5% U. S. consumption, and growing rapidly. West German chemical exports are 40% of production, and of this, nearly one-fourth goes to Central and South Africa. Japan's chemical industry is making strong headway in world markets with 20-cent-an-hour labor, even if it must import most of the raw materials.

Problems overseas, too . . . Again, the chemical-market researcher is faced with problems in helping to spell out plant locations. In the European area, he is faced with strong competition from his German or British counterpart, especially in view of the differing patterns of distribution and exchange. In the newer areas, markets are presently so small, that if a competitor also builds, there is starvation for both for an embarrassing period of time. If the customer underestimates his needs, too small a plant will be built, and production costs will crowd revenue when another supplier grants volume discounts on the difference.

Chemical market researchers are all too familiar with the former, and are probably happy to return to the "good old days" of the latter.

(Taken from paper presented at AIChE Atlantic City meeting, March 16, 1959).

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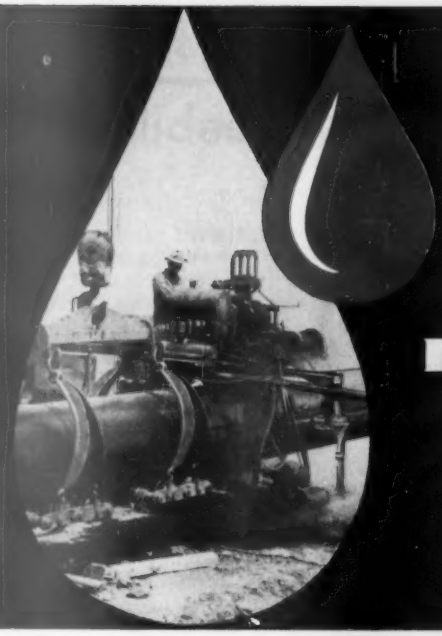

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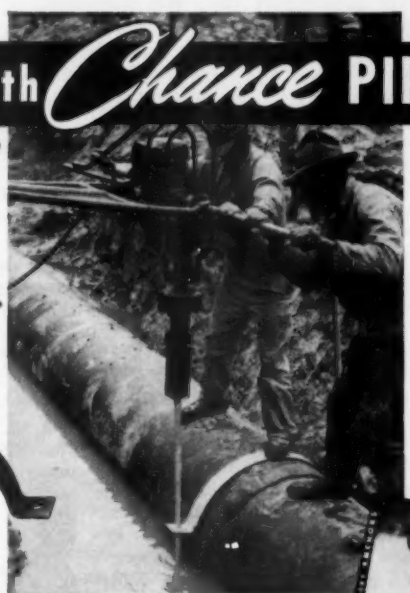

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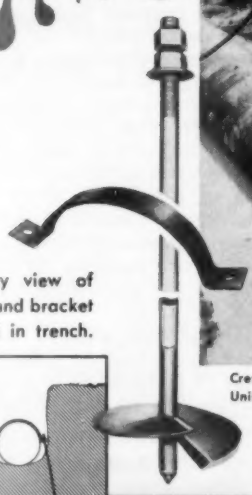
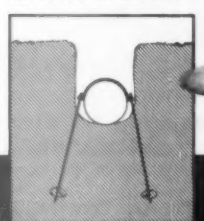


Cut-away view of anchor and bracket installed in trench.



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11. How to determine effective permeability

(a) From field data. Productivity index and capacity also calculated

BY E. T. GUERRERO
Head, Department of Petroleum Production Engineering, University of Tulsa
and
F. M. STEWART
Petroleum Engineer, Continental Illinois National Bank & Trust Co., Chicago

GIVEN: The following production and fluid-analysis data were obtained on a well in Lea County, New Mexico. It is believed that the flow from the well was stabilized.

Rate of oil flow, $Q_o = 510$ stock-tank barrels per day.

Viscosity of oil at reservoir conditions, $\mu_o = 0.14$ cp.

Oil formation-volume factor, $\beta_o = 1.95$.

Net oil-sand thickness, $h = 15$ ft.

External radius of drainage, $r_e = 750$ ft. (Assumed here as roughly half the distance between wells).

Radius of well, $r_w = 4$ in.

Static well pressure, $P_e = 5{,}170$ psia.

Flowing sand-face pressure, $P_w = 4{,}500$ psia.

FIND: The effective permeability to oil (k_o), capacity (k_oh), productivity index (PI), and specific productivity index of this well at the time of the test.

METHOD OF SOLUTION: The general equation for the determination of permeability applies to this problem.

$$k_o = \frac{\mu_o\, Q_o\, \beta_o \ln (r_e/r_w)}{7.07\, h\, (p_e - p_w)} \qquad (1)$$

Capacity is defined as the product of permeability and net sand thickness, and is expressed in millidarcy-feet.

$$\text{Capacity} = k_o h \qquad (2)$$

Productivity index (PI) is defined as production in stock-tank barrels of oil per day for each pound drop in bottom-hole pressure,

$$PI = \frac{Q_o}{(p_e - p_w)} \qquad (3)$$

and is expressed as stock-tank barrels per day per psi. Specific productivity index is found by dividing the PI by the net sand thickness to obtain stock-tank barrels per day per psi. per foot, or PI/h

SOLUTION:

$$k_o = \frac{(510)\ (1.95)\ (0.14)\ \ln 2{,}250}{(7.07)\ (15)\ (670)} = 15.1 \text{ md.}$$

$$\text{Capacity} = (15.1)\ (15) = 226 \text{ md.-ft.}$$

$$\text{Productivity index, PI} = \frac{510}{5{,}170 - 4{,}500}$$

$$PI = \frac{510}{670} = 0.761 \frac{\text{St. tk. bbl./day}}{\text{psi.}}$$

Specific productivity index,

$$SPI = \frac{0.761}{15} = 0.051 \frac{\text{St. tk. bbl./day}}{\text{psi. ft.}}$$

DISCUSSION: This problem illustrates the use of the steady-state radial flow equation in the determination of effective permeability from well test data. In a test of this type it is essential that the flow from the well be stabilized in order to assure steady-state flow. This type of flow is established when at all points within the radius of drainage the pressure does not vary with time during the test.

In the determination of effective permeability from well test data, the rate of flow Q_o is measured as a production test. The net sand thickness (h) is obtained from interpretation of well logs, samples, and core data, and includes that sand which is believed to contribute to the oil production. Static (p_e) and sand-face pressures (p_w) are measured with bottom-hole - pressure instruments. Viscosity and formation-volume factors are obtained from laboratory measurements on bottom-hole or surface-recombined samples, or if unavailable, from published correlations. The radius of drainage (r_e) is assumed equal to one-half the distance to neighboring wells.

Tests of this type are run frequently in routine production operations. If proper care is taken to stabilize the production rates for the tests then reliable effective permeability, capacity, PI, and SPI data are obtained.

The fact must not be overlooked that all these factors are directly proportional to oil saturation and may change with time.

Also the observed effective permeability may possibly be more representative than that obtained from routine core analysis. This is true because a large in-place reservoir sample is involved and the value obtained takes into consideration the presence of interstitial water, gas (if present), and well-bore damage.

It is not rare to find that the in-place effective permeability is one-tenth or less of the absolute value measured in routine core analysis. The capacity of a sand interval is more indicative of the productive ability of a well than permeability alone. A 100-ft. sand interval having a permeability of 10 md. will have a higher capacity and produce more (other things being equal) than a 9-ft. sand having a permeability of 100 md.

PI and SPI values have many applications of practical importance. Values obtained for wells in a field are a good relative measure of the permeabilities and net sand thicknesses of the areas drained by the wells. Multiplication of PI's by the reservoir pressure gives the open-flow potentials which have been used in the allocation of allowables.

A comparison of PI's before and after well workover will give an indication of the effectiveness of such operations. The decline of PI's during the life of a reservoir reflect the state of reservoir depletion. This decline should parallel the increase in gas-oil or water-oil ratios. If it is more rapid than the latter then plugging of the sand face may be indicated.

On the other hand if it does not decline as fast then this may indicate the intrusion of gas or water. Prediction of the decline in PI with decreasing oil saturation used with the material balance equation is a standard method of forecasting oil rate versus time in the solution-gas-drive reservoir.

This problem treats PI based on oil production alone. In a future installment PI problems on total liquid production and gas-well production will be presented.

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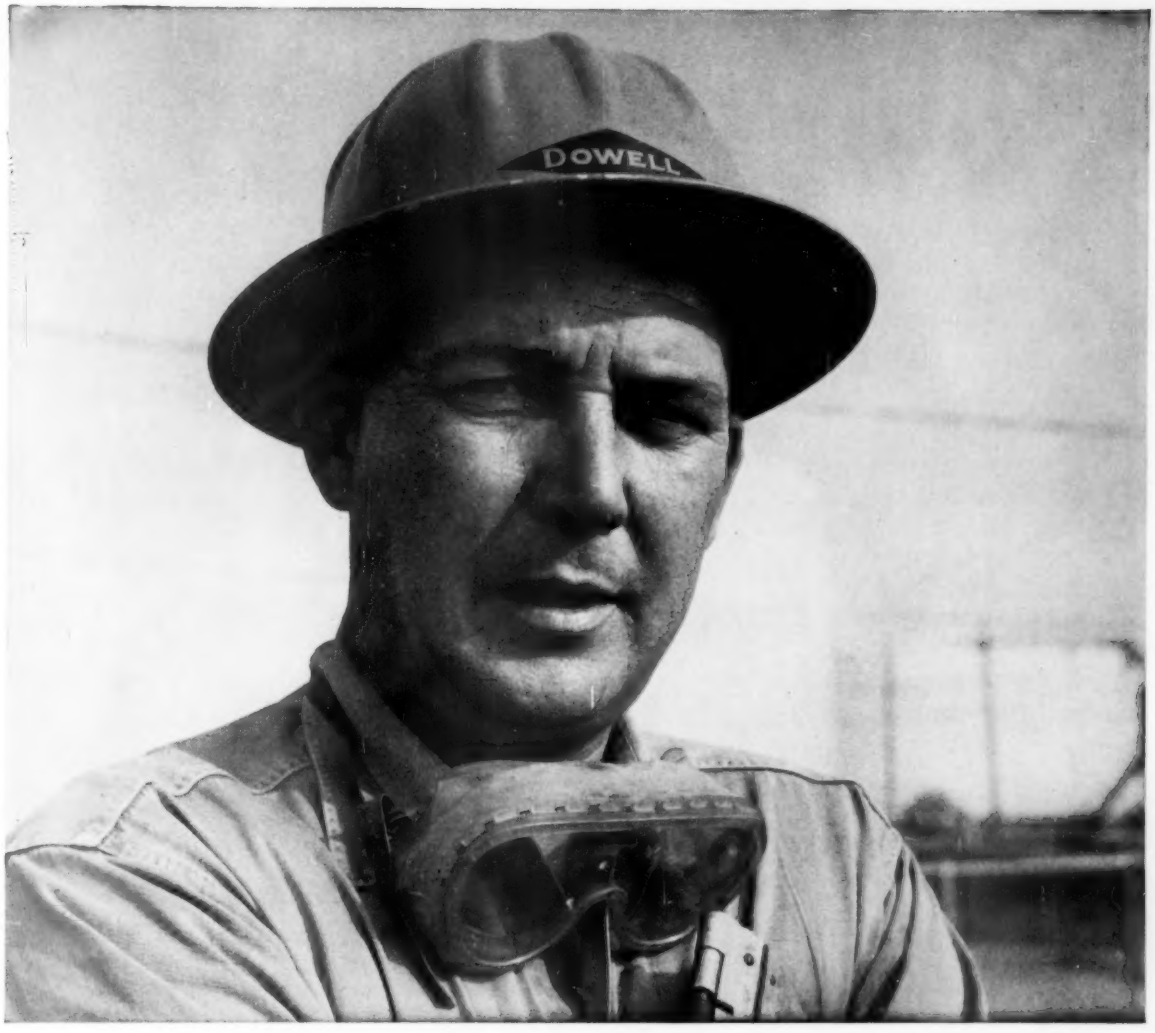

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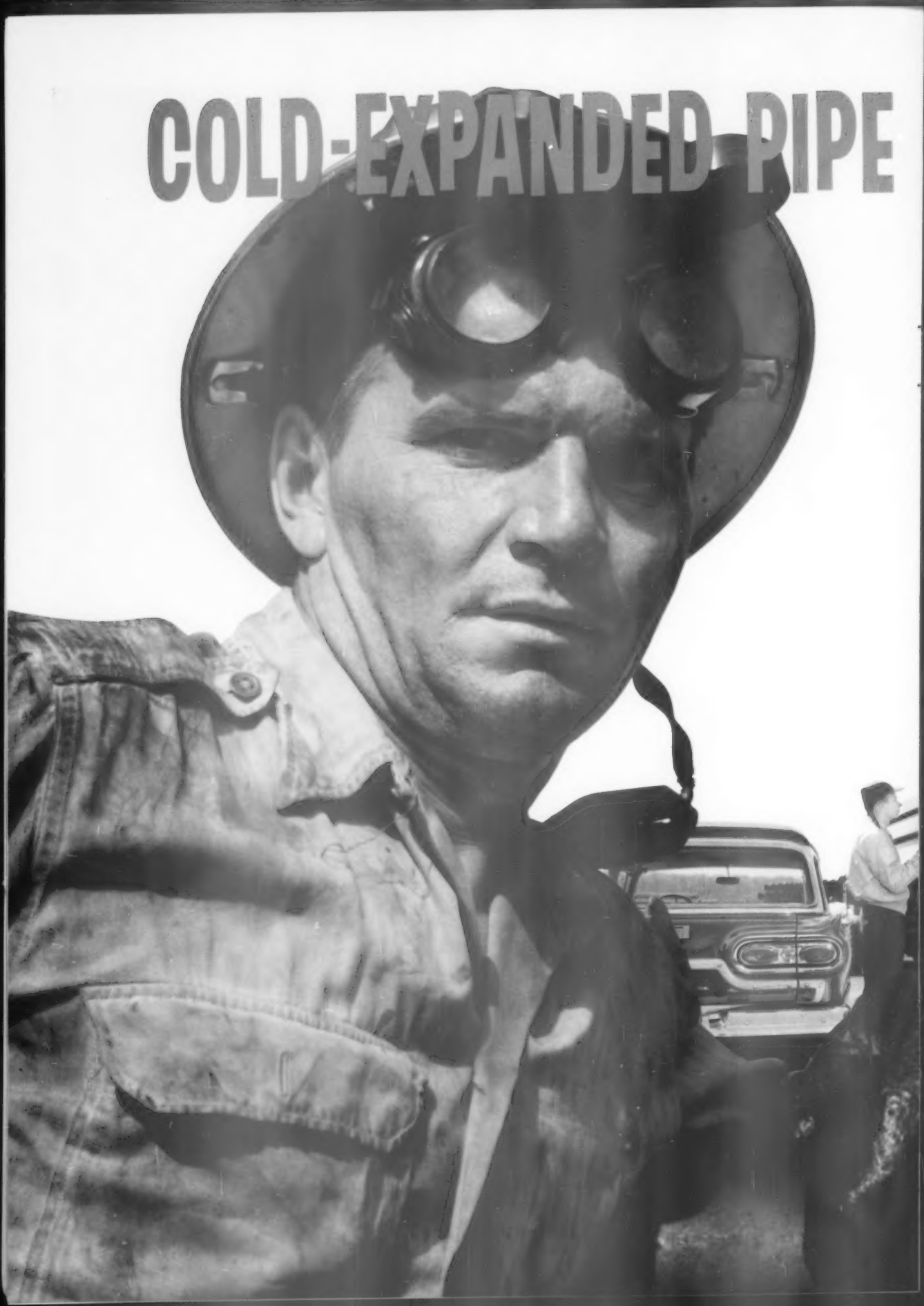

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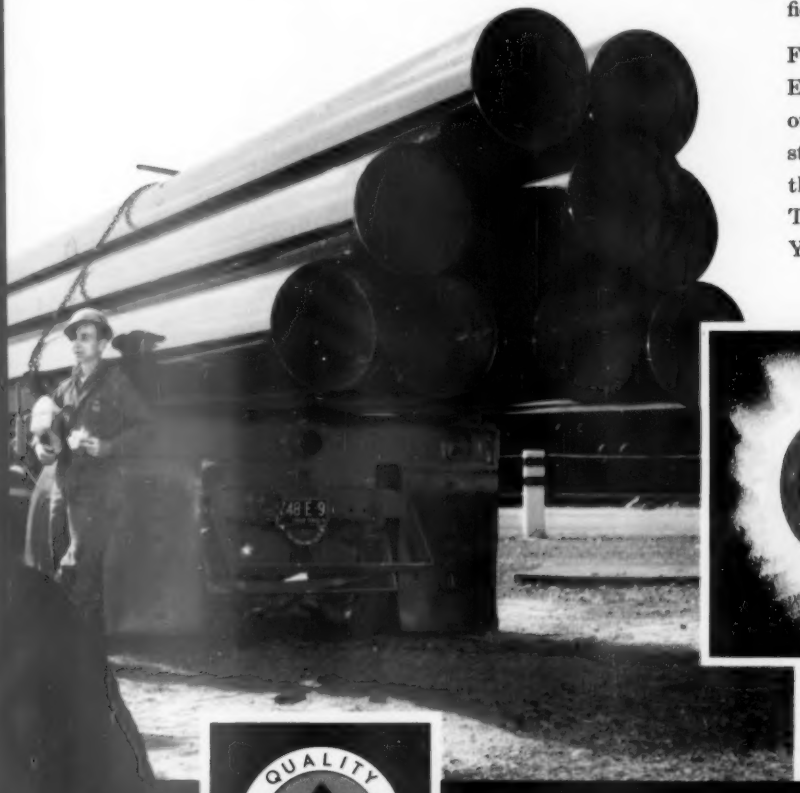

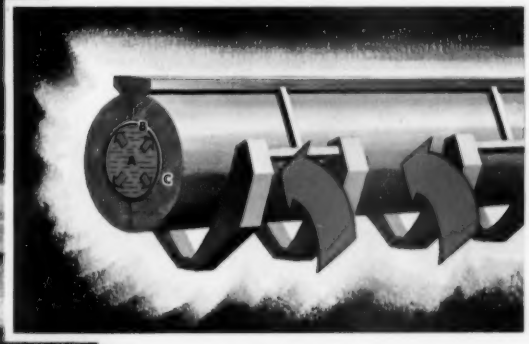

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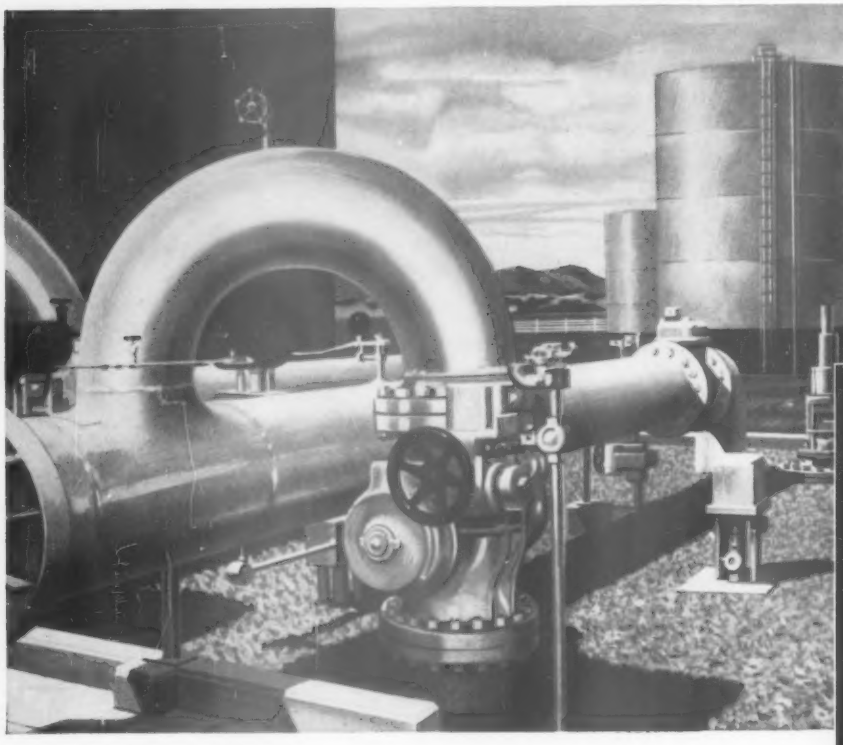

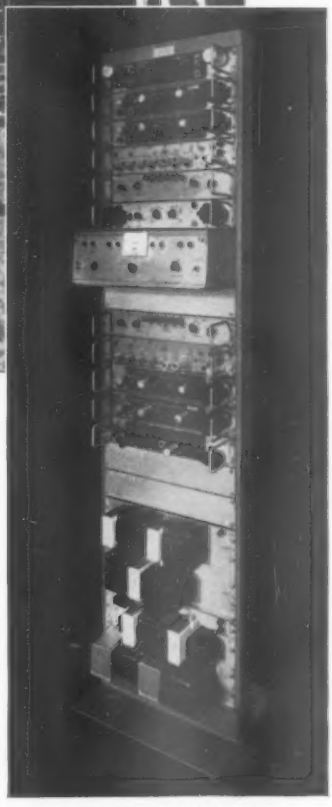

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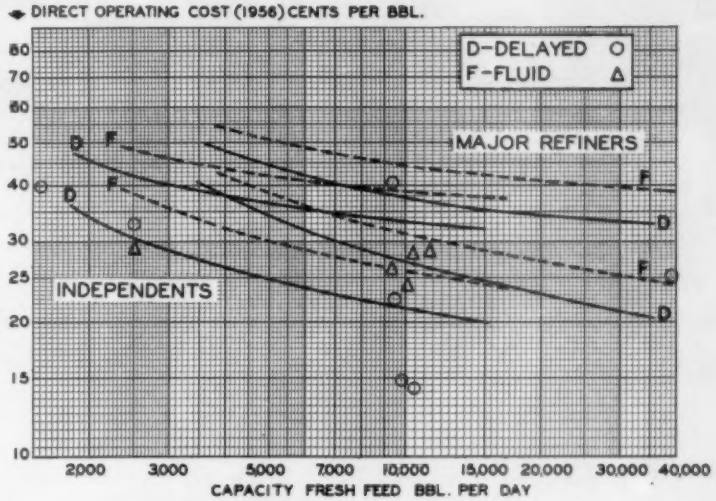
BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Operating costs—coking

DELAYED COKING differs from thermal cracking mainly in that less recycling is required (less pumping, less heat and less cooling) and more manual labor is required. Fluid coking employs no (direct) recycling at all, but power is required for operating an air blower, and much steam for stripping the coke. Table 1 indicates the basic operating cost elements, and Fig. 1 the effect of capacity and of type of management. The literature indicates some operating costs that appear to be impossibly low. The cost of thermal cracking was presented in Process Costimating No. 47, May 4, 1959, p. 122.



OPERATING COSTS (1956) of coking plants. Fig. 1.

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TABLE 1—ELEMENTS OF OPERATING COSTS—COKING (FLUID OR DELAYED)

Element†		Unit (somewhat standard)	1956 Unit cost	Cents per bbl. (10,000 BPD plant)	See Process Costimating No.:
Labor—supervision		0.5-1.0 men/8-hr. shift*	$3.85 per hr.†	0.46-0.92	26, 28, 41
Labor—operating		3.5-7.0 men/8-hr. shift*	$2.90 per hr.†	2.44-4.8	
Maintenance		5-6%/yr. of replacement cost	$308-$393/daily bbl.‡	4.22-6.45	29
Fuel	—Delayed	300,000-630,000 B.t.u./bbl.§	25-40 ct./M.M. B.t.u.	7.5-25.2	3, 4, 6
	Fluid	350,000-440,000 B.t.u./bbl.§	25-40 ct./M.M. B.t.u.	(8.7-17.6)**	
Power	—Delayed	0.016-0.073 b.hp.-hr./bbl.¶	0.9 ct./hp.-hr.	0.34-1.6	
	Fluid	0.014-0.021 b.hp.-hr./bbl.¶	0.9 ct./hp.-hr.	(0.3-0.45)	
Steam	—Delayed	2-3.5 lb./bbl.¶	45-60 ct./M. lb.	0.10-0.2	
	Fluid	60-190 lb./bbl.¶	45-60 ct./M. lb.	(2.7-11.4)	
Water cooling	—Delayed	130,000-330,000 B.t.u./bbl.	1.7 ct./M. gal.‖	0.88-2.25	15, 16
	Fluid	230,000-400,000 B.t.u./bbl.	1.7 ct./M. gal.‖	(1.6-2.7)	
Chemicals		(lime, inhibitors, etc.)		0.1-0.2	
Compression		(gas handling is charged to gas-recovery plant)		.....	
TOTAL DIRECT COST (probable extremes)—	Delayed			18.5-39.0	
	Fluid			18.1-42.0	
Obsolescence		1%/yr. of replacement cost	$308-$393/daily bbl.‡	0.84-1.08	
Insurance and taxes		2%/yr. of replacement cost	$308-$393/daily bbl.‡	1.69-2.15	
Interest or dividends		4%/yr. of replacement cost	$308-$393/daily bbl.‡	3.37-4.30	
Laboratory supervision		0.2-0.4 men/shift	$3.12	0.15-0.30	26
Royalty		(to be arranged)		.....	
				6.2-7.6 plus royalty	

*Lowest figure is average for independent refiners and large figure for government-operated plants or major refiners. †Average U. S. wages plus 27% for all burdens, but reduced from $3.12 to $2.90 per hour because of large proportion of manual labor for cleaning stills. Fluid coking probably requires about 15% less labor but at a slightly higher hourly cost. ‡See Costimating No. 28, April 15, 1957, for 10,000-bbl. per day plant. Delayed and fluid plants cost almost the same. §Heat generated—the heat absorbed is less by the amount of efficiency of the heater. ¶Assuming only feed pump is steam driven. The fluid process uses larger amounts of power for air blowing and large amounts of steam for stripping the coke. ‖250,000 B.t.u. per 1,000 gal. at a rise of 30° F. **Feed or coke itself is also burned but this cost appears as a loss in product yields.

Exterior view of Utica Station.

The three compact 6-cylinder Cooper-Bessemer GMVC Compressors are rated 1000 hp at 300 rpm. Two have been in service since 1957. One was added in 1959.

Victor G. Fulkerson, *Head Engineer, Utica Station, New York State Natural Gas Corporation, explains...*

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FOREMAN'S PAGE

PART 1—SAFETY AND BLOWDOWN FACILITIES

Here are some practical safety rules for dealing with

Pressure-relief devices

IN THE DESIGN of refining equipment, there are included many elaborate safety features for protection of personnel and equipment.

Pressure-relieving devices are installed to prevent excessive pressures which might arise in vessels because of fires or equipment failures or errors in operation. Facilities are provided to safely dispose of the material discharged through the relief devices.

Facilities are usually included to remove any light-hydrocarbon inventory from the vessels during an emergency without resorting to the automatic pressure-relief system. The facilities which are installed to handle the discharge of the vapors and liquids are called "safety and blowdown" facilities. The trend towards expanded light-ends operations has made it increasingly necessary to adopt precautionary measures and install extensive facilities for the sake of safety.

Blowdown System

Four basic principles have been adopted as a guide to what may be considered excellent safety facilities:

1. Gas or vapor can be released to the atmosphere only in a safe location.

2. Adequate equipment should be provided for the rapid and safe removal of the liquid from the major vessels.

3. Facilities should be provided for receiving and temporarily storing light-hydrocarbon liquids withdrawn from equipment.

4. Blowdown systems should be so arranged or interconnected that all parts can be inspected without abnormal equipment shutdowns.

A typical blowdown system for a unit processing light ends is shown in Fig. 1. Although safety valves which discharge vapors at a high point in a safe location may discharge to the atmosphere, safety valves are usually tied in to release headers which discharge either vapor or liquid through a closed system to a horizontal disengaging drum.

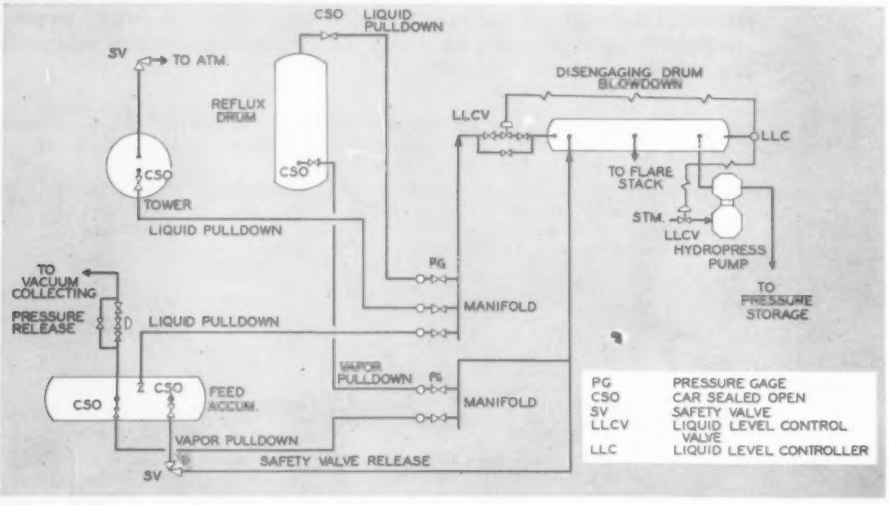
The disengaging drum has an overhead vapor release leading to a flare stack. A pump takes suction on the drum and removes the hydrocarbon liquid to suitable storage vessels. A vapor "pulldown" system may also be included and usually consisted of a small vapor line running from the top of each vessel to a manifold which discharges to the disengaging drum.

The vapor pulldown is often useful in forestalling safety-valve discharges but is usually of greatest service in startup and shutdown operations. It is desirable to forestall safety-valve discharges if possible because often the valve will not reseat correctly and vapors will continue to leak through.

There is also a liquid pulldown system. In new designs this consists of lines from the bottoms of vessels extending to a manifold which discharges to the disengaging drum. The lines are provided with valves sealed open at the vessels and the control manifold is so located as to permit emptying the vessels readily even if they become inaccessible because of fire.

To avoid flooding the blowdown drum (disengaging drum) and the subsequent discharge of liquid to the flare stack, automatic instruments should be provided to prevent overfilling the drum. Level alarms should be installed, and the drum level should automatically control steam-inlet valves on the turbine-driven liquid pumps. The level control should also close off a valve in the liquid-inlet line when the drum level reaches a designated point. Liquid pumps are now big enough to remove the liquid contents of an integral section of a unit in 20 minutes.

This material taken from process-training-program manual, Baton Rouge, La., refinery of Esso Standard Oil Co.



TYPICAL blowdown system for a unit processing light ends. Fig. 1.

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Water + fluid-loss reducer = good workover, cleanout fluid

Here are case histories on six Texas and two Oklahoma wells

BY F. O. JONES AND J. L. LUMMUS
Pan American Petroleum Corp., Tulsa

FLUID-LOSS REDUCERS have been developed which make clear water an excellent fluid for completing wells, reworking them, or cleaning them out.

In field tests, some wells would not stand full of untreated clear water. When the fluid-loss reducer was added it was possible to circulate the wells. The fluid-loss reducers are effective over a wide range of permeability, in the presence or absence of oil saturation, in either clay-containing or clay-free formation, and do not significantly affect productivity.

The agents are used in small concentrations, ranging from 0.05 to 0.15% by weight, or 0.15 to 0.5 lb. per bbl. A vegetable gum compound* and a mixture of starch and bentonite appear to be the most effective of the additives tested.

Why it is needed . . . A drilling, completion, or workever fluid should have a low filtration loss to avoid forming a thick mud filter cake on the wall of the hole and to minimize flushing of productive zones. If a low-density fluid can be used, clear water has advantages of faster penetration rates, greater footage per bit, and lower costs. Moreover, a clear-brine completion of workover fluid results in faster and cleaner repair jobs than does mud.

Disadvantage of clear water or brine systems is that fluid loss is often too high. It is sometimes difficult even to circulate the well when fluid loss is extremely high. When fluid loss is too high, it is hard to circulate sand and debris from the well. There is also danger of sticking the tools.

To get the advantages of clear water without its disadvantages, tests were made to develop agents which would reduce its filtrate loss. After many materials were evaluated in the laboratory, two were tried in the field. Table 1 is a summary of the eight tests in which small concentrations of the materials (0.05 to 0.15%) were used for controlling fluid loss during workover or well completion. A vegetable gum was used in eight wells and a combination of starch and bentonite was used in one.

In all tests, these materials were added to salt water. In example No. 1, a brine treated with vegetable-gum compound was successful in washing sand from bottom whereas the hole would not stand full of water without the additive. The field-test case histories are given in detail below.

In six Texas wells . . . A brine treated with the vegetable-gum compound was used to wash sand from a Brazoria County, Texas, well. Previously, the hole would not stand full of either salt water or lease crude. However, the hole was filled with a mixture of 242 bbl. of salt water and 68 lb. of vegetable gum (0.281 lb. per bbl.). During the 15-day workover, another 546 bbl. containing 0.175 lb. per bbl. of vegetable gum was used in circulating to keep the hole full.

Cost of the vegetable gum in this workover was $210. Compared with the alternative of using mud, the vegetable gum made a big saving in cost.

It was necessary to wash sand and set screens in three wells in Harris County, Texas, wells. None of them would stand full of untreated salt water. However, each was successfully filled with brine containing from 0.175 to 0.5 lb. per bbl. of vegetable-gum compound.

During the rework, circulation was lost intermittently. Total loss was

*Visco-sal.

This article is taken from a paper titled, "Fluid-Loss Reducers for Clear Water," presented at 1959 spring meeting, API Division of Production's Mid Continent District, Amarillo, Tex.

TABLE 1—FIELD TESTS USING FLUID-LOSS REDUCERS FOR CLEAR WATER

No.	Location	Type Agent Used	Use	Results
1.	Brazoria Co., Texas	Veg. Gum	Workover, 1 well	Successfully circulated sand from hole which would not hold untreated salt water.
2.	Harris Co., Texas	Veg. Gum	Workover, 3 wells	Successfully filled wells which would not hold untreated brine; however, experienced intermittent high loss when circulating.
3.	Brazoria Co., Texas	Veg. Gum, Starch-Bentonite	Workover after completion, 2 wells	Successfully killed well and permitted dual completion work not possible with untreated salt water.
4.	Garvin Co., Oklahoma	Veg. Gum	Workover after completion, 1 well	Used in two zones in multiple completion. High loss in fractured zone.
5.	Grady Co., Oklahoma	Veg. Gum	Workover after completion, 1 well	Successfully killed gas well. Permitted rapid recovery after installation of equipment.

about 1,000 bbl. of brine per well. Differential pressure toward the formation was about 3,000 psi. There is possibility that the losses were to fractures, however. This fact suggests that in some cases it may be desirable to add finely ground loss-of-circulation material.

In the first of two Brazoria County, Texas, wells, 300 bbl. of 9.4-lb. per bbl. salt water containing 0.67 lb. per bbl. pregelatinized starch and 0.33 lb. per bbl. of bentonite was used with success in making a dual completion. Later there was a tubing failure and the well had to be pulled. This time the well would not hold untreated salt water. Subsequently it was circulated with 9.4-lb. per gal. salt water containing 80.18 lb. per bbl. of vegetable gum. After this, there was no loss of fluid. The workover was considered successful.

On the second well, a dual completion was to be repaired. Previously, there had been a big loss of untreated water to the formation. This loss caused trouble in returning the upper zone to production. A similar 9.5-lb. per gal. salt water was treated with 0.18 lb. per bbl. of the vegetable gum to do a subsequent workover. In this later job there was no loss to the formation. Both the upper and lower sands were swabbed into production with no difficulty. For its results, it was an entirely satisfactory workover job.

On two Oklahoma wells . . . In Garvin County, Oklahoma, a well was multiply completed using a brine treated with 0.174 lb. per bbl. of vegetable gum. A nearby well had been completed using untreated brine and it was possible to compare the two. Both wells had lost circulation with mud into one zone when the wells were drilled. Neither well lost circulation while drilling in the second zone. During completion, both wells lost brine into the zone of lost circulation and the treating agent did not help.

In the other zone, production was swabbed in without difficulty in both wells. The test was inconclusive since no difficulty was experienced with one zone and both wells lost brine to the lost-circulation zone which was presumably fractured since it accepted whole mud during drilling. This test does indicate, however, that the agent probably would not be effective for reducing loss into fractured zones unless possibly lost-circulation material was also used.

In Grady County, Oklahoma, salt water treated with vegetable-gum compound was used to kill a gas well after perforating and sand-oil treatment. After installation of equipment, a few pulls of the swab broke gas through. Gas-production rates increased rapidly to the amount being produced prior to killing the well with treated salt water. Very little water was removed during swabbing. The treatment was considered successful. Cleanup time would have been much longer if untreated salt water had been used, according to area personnel.

In one field the use of vegetable gum compound for treating workover fluids was not successful. The reasons for these failures are not known but improper mixing, loss of vegetable gum compound through flocculation, high bottom-hole temperature, or presence of fractures may have been factors.

Mixing precautions . . . In the field tests the materials were added to fresh water or brine using conventional rig mixing equipment or pump-truck units furnished by well-servicing companies. The materials were added slowly and agitated vigorously to insure adequate dispersion. In some instances, to insure good blending, the treated water was circulated through a jet mixer or through mud guns for periods of 30 minutes to several hours.

There was some difficulty in getting enough dispersion of the materials in the field. The materials should be added to the circulating fluid very slowly to prevent lumps from forming. The system must be circulated at least a half hour after adding the agents to insure dispersion and softening of the materials. Best method of insuring adequate dispersion is use of premixed concentrates. The vegetable-gum compound may be premixed in

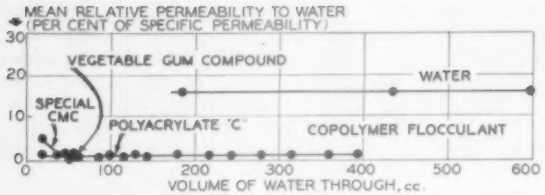
TABLE 2—EFFECTS OF FLUID-LOSS REDUCERS FOR CLEAR WATER
(Standstone rocks as filter septa—pressure 1,000 psi.)

Conc. (%)	Water	Per cent solids	Temp. (°F.)	K, md.	Spurt, cm.	Rate factor, cm. per min.$^{1/2}$	Equivalent API fluid loss (excl. spurt) cc. per 30 min.
		Vegetable-Gum Compound					
0.05	Fresh		77	6.5	3.3	0.24	59
0.05	Fresh		125	9.6	1.0	0.31	76
0.05	Fresh	0.05 $CaCO_3$	77	1.2	0.0	0.18	44
0.05	Fresh	0.05 $CaCO_3$	135	7.2	0.0	0.25	61
0.05	Fresh	0.05 $CaCO_3$	196	6.8	—0.16	0.54	130
0.025	Sat'd NaCl		77	84.0	6.07	0.29	71
0.05	Sat'd NaCl		77	139.0	3.28	0.18	44
0.10	Sat'd NaCl		77	139.0	7.32	0.14	34
0.05	Sat'd NaCl		77	25.0	3.17	0.19	47
0.05	Sat'd NaCl		125	19.0	2.68	0.24	59
0.05	Sat'd NaCl		190	27.0	3.23	0.31	76
0.05	Sat'd NaCl*		77	60.0	4.43	0.19	47
		Pregelatinized Starch					
0.2	Fresh		77	16.1	2.07	0.10	25
0.05	Fresh	0.05 $CaCO_3$	125	16.1	0.11	0.32	79
0.05	Fresh	0.06 Bent.	77	11.2	0.14	0.32	79
0.05	Fresh	0.06 Bent.	121	18.3	7.1	0.36	89
0.05	Fresh	0.6 Bent.	77	3.1	—0.05	0.23	57
0.05	Fresh	0.6 Bent.	131	14.4	0.13	0.25	61
0.05	Sat'd NaCl		77	61.0	Apr. 9	1.0	250
0.15	Sat'd NaCl		77	43.0	4.0	0.59	145
0.30	Sat'd NaCl		77	28.0	1.2	0.37	91
0.15	Sat'd NaCl		77	20.0	1.8	0.36	88
0.15	Sat'd NaCl		125	23.0	1.2	0.72	117
0.15	Sat'd NaCl		190	27.0	3.0	0.15	36
0.05	Sat'd NaCl	0.1 Bent.	77	82.0	2.1	0.56	136
0.15	Sat'd NaCl	0.05 Bent.	77	86.0	1.9	0.32	77
0.15	Sat'd NaCl	0.10 Bent.	77	79.0	1.1	0.32	77
0.15	Sat'd NaCl	0.30 Bent.	77	82.0	0.9	0.32	77

Miscellaneous Materials

Water	Material	Temp. (°F.)	K, md.	Spurt, cm.	Rate factor, cm. per min.$^{1/2}$	Equivalent API fluid loss (excl. spurt) cc. per 30 min.
Fresh	0.05 Sp. CMC and $CaCO_3$ 0.05	77	1.3	—0.33	0.32	79
Fresh	0.05 Sp. CMC and $CaCO_3$ 0.05	125	9.6	0.0	0.39	96
Fresh	0.05 Sp. CMC and $CaCO_3$ 0.05	195	8.8	0.0	0.52	128
Fresh	0.05 Sp. CMC and 0.05 Bentonite	77	8.1	0.0	0.15	37
Fresh	0.05 Sp. CMC and 0.05 Bentonite	125	9.9	0.19	0.19	47
Fresh	0.05 Polyacrylate	75	4.1	2.7	0.39	96
Fresh	0.05 Polyacrylate	125	3.8	0.0	0.84	207

*Aged 12 days.



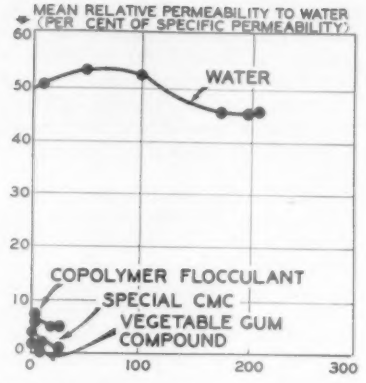
EFFECT on mean relative permeability to water. Fig. 1.

LEGEND FOR FIG. 1

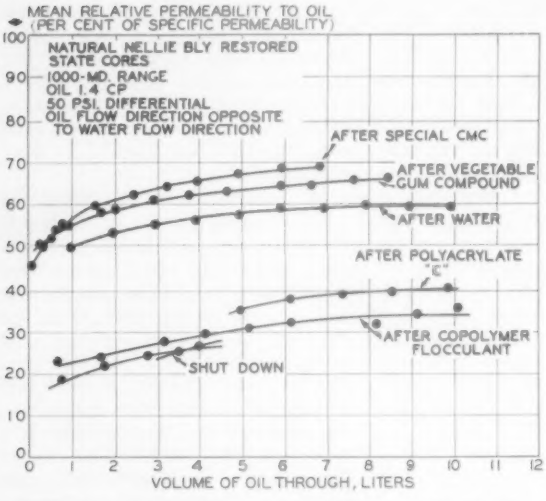
Natural Nelly Bly restored-state cores.
1,000-md. range.
0.05% solutions.
50-psi. differential.
Water-flow direction opposite to oil-flow direction.

LEGEND FOR FIG. 3

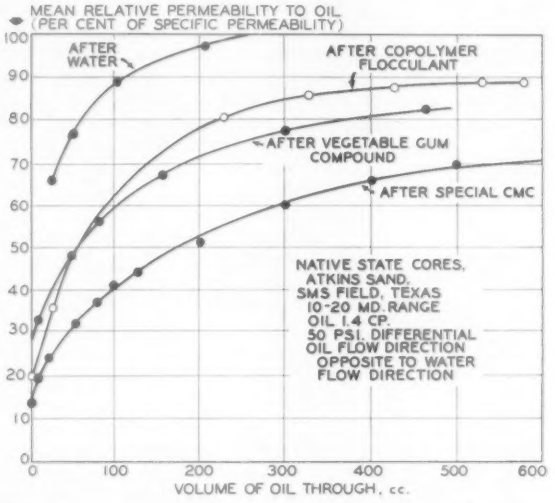
Native-state cores, Atkins sand, SMS field, Texas.
10-20 md. range.
0.05% solutions.
50-psi. differential.
Water-flow direction opposite to oil-flow direction.



EFFECT on mean relative permeability to water. Fig. 3.



EFFECT on mean relative permeability to oil. Fig. 2.


MEAN RELATIVE PERMEABILITY TO OIL
(PER CENT OF SPECIFIC PERMEABILITY)
AFTER WATER
AFTER COPOLYMER FLOCCULANT
AFTER VEGETABLE GUM COMPOUND
AFTER SPECIAL CMC
NATIVE STATE CORES, ATKINS SAND, SMS FIELD, TEXAS
10-20 MD. RANGE
OIL 1.4 CP.
50 PSI. DIFFERENTIAL
OIL FLOW DIRECTION OPPOSITE TO WATER FLOW DIRECTION
VOLUME OF OIL THROUGH, cc.

EFFECT on return mean relative permeability to oil. Fig. 4.

THESE FIGURES show results of permeability tests. Figs. 3 and 4 show that the materials sharply reduce the flow capacity of rock to water but do not seriously impair its flow capacity to oil.

solutions up to 1%, starch up to 3%, and bentonite up to 6%.

When bentonite is used in salt water, it should be added dry because it will disperse rapidly in salt water. When treating fresh water, however, bentonite should be added as a predispersed slurry. A bentonite fresh-water slurry should not be added to brine because flocculation will result.

Vegetable-gum compound in brine should not be mixed or the solution stored in unlined earthen pits because flocculation may occur. Care must be taken not to contaminate the solution with mud or other solids which could remove the gum by flocculation. Bentonite may be used with vegetable gum compound in fresh water without flocculation but not in brine. If vegetable gum compound is used to remove solids from brine by flocculation, a premixed concentrate of the gum must be prepared in clear brine and the concentrate added, inasmuch as dispersion of the dry gum is inhibited by solids. After solids are removed, the brine may be treated conventionally for controlling fluid loss.

The fluid-loss reducers were evaluated in tests using sandstone disks rather than filter paper. This is because filtration rates using paper proved to be unrealistic on water containing little solids material.

In initial tests, conventional permeability measurements compared flow rates of untreated and treated water through sandstone cores. This showed any effects the waters might have on oil permeability. The cores were 1 in. long and 0.75 in. in diameter. The liquids were flowed at a pressure of 50 psi. across the cores to minimize relative permeability end effects. Oil was flowed in the direction opposite to the water to simulate production of oil from a formation. The fluids were in laminar flow.

In a different series of tests, similar to API-mud filtration tests,[1] sandstone disks were used as septa rather than filter paper. A Model 380 Baroid High Temperature-High Pressure mud filter press was modified to accept the disks. This was done by scoring the bottom plate to permit flow underneath the filter, omitting the paper support screen, and using a large "O" ring to seal in the disks.

The disks were sliced from cores mounted in Plexiglass and then turned down to 5.33-cm. diameter. The disks were 0.5 cm. thick with filtration areas averaging 18.3 sq. cm. Disk permeabilities ranged from about 10 md. to about 150 md. The permeability range from 10 md. to 150 md. was selected because it is representative of many subterranean rocks. Disk thickness of 0.5 cm. was used, not only because of easy adaptation to the filter press but also because to insure that the agents found effective did not depend upon excessive penetration into the rock. The disks were discarded after being used once.

The sandstone disks were evacuated and saturated with water. The saturated disks were pressed into an "O" ring, placed in the bottom of the cell, and the cell assembled. A 25-cp. oil was then flowed through to reduce residual water saturation to a mini-

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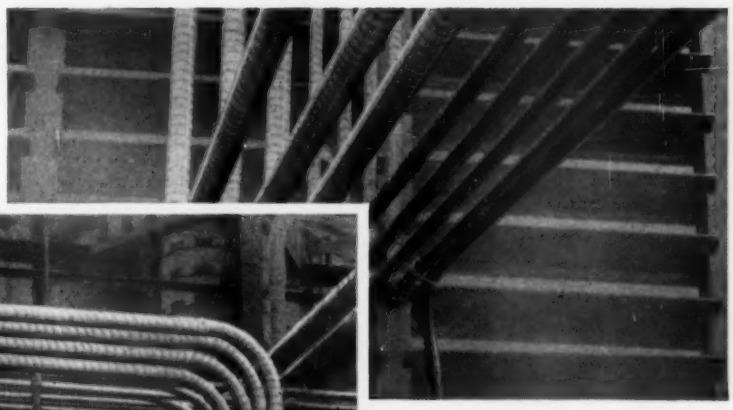

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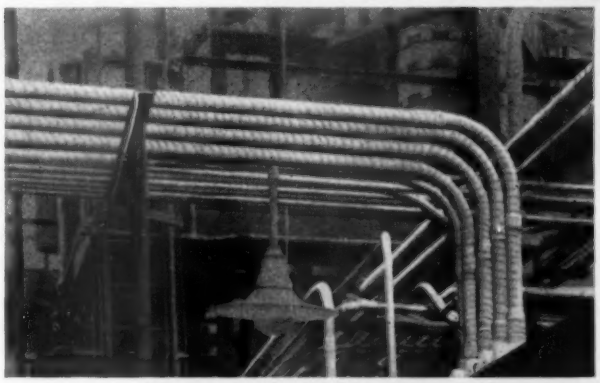

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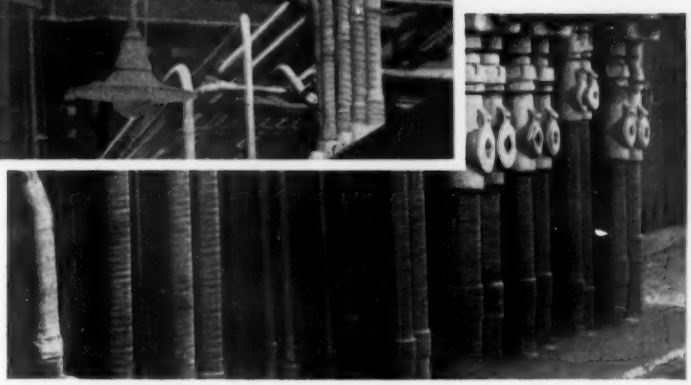

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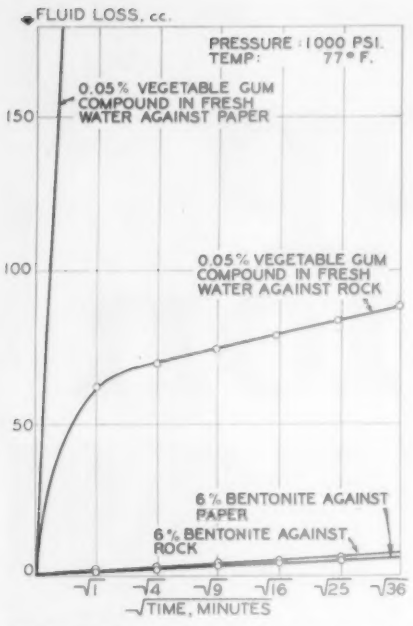
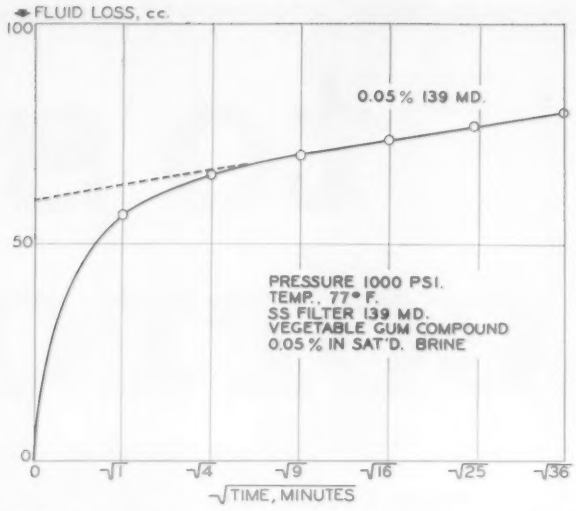


COMPARISON of rock and paper as filtration septa. Fig. 5.



EFFECT of vegetable-gum compound on fluid loss of brine. Fig. 6.

mum. Permeabilities of the disks were determined by flowing 1.4-cp. oil at 20 psi.

The effect of various colloids in reducing the flow rate of water through the sandstone disks was determined. Numerous materials, including several polyelectrolytes and natural gums, were studied. The materials were added to tap water or brine, preheated to a specified temperature, and poured into the cell which had been preheated to the same temperature. Cumulative filtrate volume was recorded at 1, 4, 9, 16, 25, and 36 minutes to facilitate plotting filtrate volume against the square root of time. The filtration tests were conducted at pressures up to 1,000 psi. and temperatures up to 190° F.

What tests showed . . . Figs. 1 through 4 show results of the permeability tests. Fig. 1 shows the effects of distilled water, a special grade of sodium carboxymethyl cellulose (CMC), a calcium salt of a carboxyl containing high-molecular-weight copolymer (polyacrylate "C"), a vegetable-gum compound, and a carboxylic acid—acrylamide copolymer (copolymer flocculant), on the flow capacity of Nellie Bly sandstone cores to water. Fig. 2 shows the effects of these same materials on the return permeability of Nellie Bly sandstone cores to oil. Figs. 3 and 4 show the results of similar experiments using native-state cores from the Atkins sand. The latter tests show that the materials sharply reduce the flow capacity of rock to water but do not seriously impair its flow capacity to oil.

Table 2 is a summary of the data on various fluid-loss reducers for water and brine using the modified filter press. A comparison of conventional filter paper and sandstone disks as filtration septa is shown in Fig. 5. The results show that a 6% bentonite slurry exhibits nearly the same fluid-loss properties when filtered through either paper or rock. However, in similar filtration experiments using a 0.05% solution of the vegetable-gum compound in fresh water, results were entirely different. When paper was used as the septum, a 250-cu. cm. capacity filter press was emptied in about 25 seconds at 1,000 psi., whereas with rock as the septum, the fluid loss was drastically reduced after an initial period of high loss. Fig. 6 shows that the vegetable gum compound is also effective in brine for reducing fluid loss.

The permeability experiments were performed on "restored-state" cores which, prior to introduction of untreated or treated water, contained oil and water saturation in the proportions that would be expected in the reservoir. The tests were to determine the effectiveness of the fluid-loss reducers in the presence of oil saturation and to observe effects on oil permeability.

By comparing Figs. 1 and 3, it can be seen that on a percentage basis the materials reduce loss into 1,000-md. Nellie Bly sandstone about as well as into 10-md. Atkins sand. Figs. 2 and 4 show that oil permeability is recovered satisfactorily, especially after special CMC and the vegetable-gum compound. The amount of reduction in oil permeability should have a negligible effect on production from a well, inasmuch as the depth affected is small.

Theory behind tests . . . Fig. 5 shows the reasons why the standard API test cannot be used to determine fluid-loss of fluids containing small amounts of solids.

In Fig. 5 the fluid lost from mud and from treated water through paper septa is compared to that through rock septa. The results obtained using mud against filter paper and against rock are about identical but the fluid loss of treated water through paper is many times greater than the fluid loss of treated water through rock. It can therefore be seen that rock rather than filter paper should be used when measuring filtration of water containing small amounts of solids. Factors which enter into this include differences in texture between paper fibers and sand granules and the difference in thickness of the septa. Regardless of the reasons for difference, the results using rock are considered better because of the closer resemblance to well conditions.

In Figs. 5 and 6, where filtration behavior is shown, cumulative filtrate loss in cubic centimeters is plotted against the square root of time in minutes. This is in accord with accepted filtration theory.[2]

These same figures show that, in testing the treated waters against sandstone disks, the filtration rate is extremely high for a short time, but then slows so that the curve flattens

and follows a straight line in accordance with theory. The slope of this straight-line portion of the curve is a measure of the long-term filtration behavior. If the straight-line portion of the curve is extrapolated back to the filtrate axis, as indicated in Fig. 6, the volume represented by the intersection of the extrapolated straight line and the volume axis can be taken as a measure of the nonideal behavior occurring in the first few instants of filtration.

This high initial loss represents only a small part of the total amount lost during filtration lasting many hours or days. Therefore, the important characteristic is the value of the slope of the straight line. The term "rate factor" is assigned to the expression which is computed from the slope of the straight line, and the term "spurt value" is assigned to the number computed from the intercept of the extrapolated straight line and the filtrate volume axis. The slope in cubic centimeters per minute$^{1/2}$ is divided by the filtration area in square centimeters to yield the rate factor in cubic centimeters per square centimeter-minute $^{1/2}$ or centimeters per minute$^{1/2}$. Similarly, the intercept in cubic centimeters is divided by the filtration area in square centimeters to give the spurt value in cubic centimeters per square centimeter or centimeter.

For example, extending the straight-line portion of the curve in Fig. 6 to the ordinate axis gives a value of 59.5 cc. Dividing by the area, 18.3 sq. cm., a spurt value of 3.3 cm. is found. 79.5 cc. was delivered in 36 minutes. Subtracting from this the intercept value of 59.5 cc. and dividing this difference by both the square root of 36 minutes and by the area, 18.3 sq. cm., the rate factor, 0.18 cm. per minute$^{1/2}$, is found.

For the purposes of this discussion, filtration where high "spurt" occurs is best represented by a spurt value and a rate factor rather than by a single value such as cc. per 30 minutes.[3 4 5] For instance, a fluid with no spurt and a 25 cc. per 30-minute loss is a much poorer fluid than a fluid which gives a 15-cc. spurt and likewise loses a total of 25 cc. in 30 minutes. The first fluid behaves, of course, like a 25-cc. per 30-minute fluid during the entire course of filtration. The second fluid, after the initial spurt loss, behaves like a much slower-filtering fluid over most of the course of filtration and, over several days' time, will result in losing less than half the filtrate lost by the first fluid.

Following from the foregoing, it can be seen that it is possible for a treated water to have a high 30-minute loss yet actually to more nearly resemble a low-filtrate-loss fluid in its behavior over longer periods of time.

Table 1 includes, for better understanding of the effectiveness of the treating agent, an "API fluid-loss equivalent value, exclusive of spurt." This value in effect describes what the 30-minute API fluid loss of the treated water would be if there were no initial spurt loss. To illustrate: For the fluid in Fig. 6 the API equivalent value is computed by multiplying the rate factor, 0.18 cm. per minute$^{1/2}$, by the square root of 30 minutes, 5.48$^{1/2}$, and by the area of the API filter press, 45 sq. cm. to give a 44 cc. API equivalent loss. The pressure used in these tests, however, was 1,000 psi. rather than 100 psi.

Gum and starch chosen . . . Table 1 gives results of a number of representative filtration tests. The results, reported in terms of spurt value, rate factor, and API equivalent values, are concerned chiefly with the vegetable-gum compound and pregelatinized starch. These materials were chosen not only because of their effectiveness but also because of their ready availability. The special CMC, although

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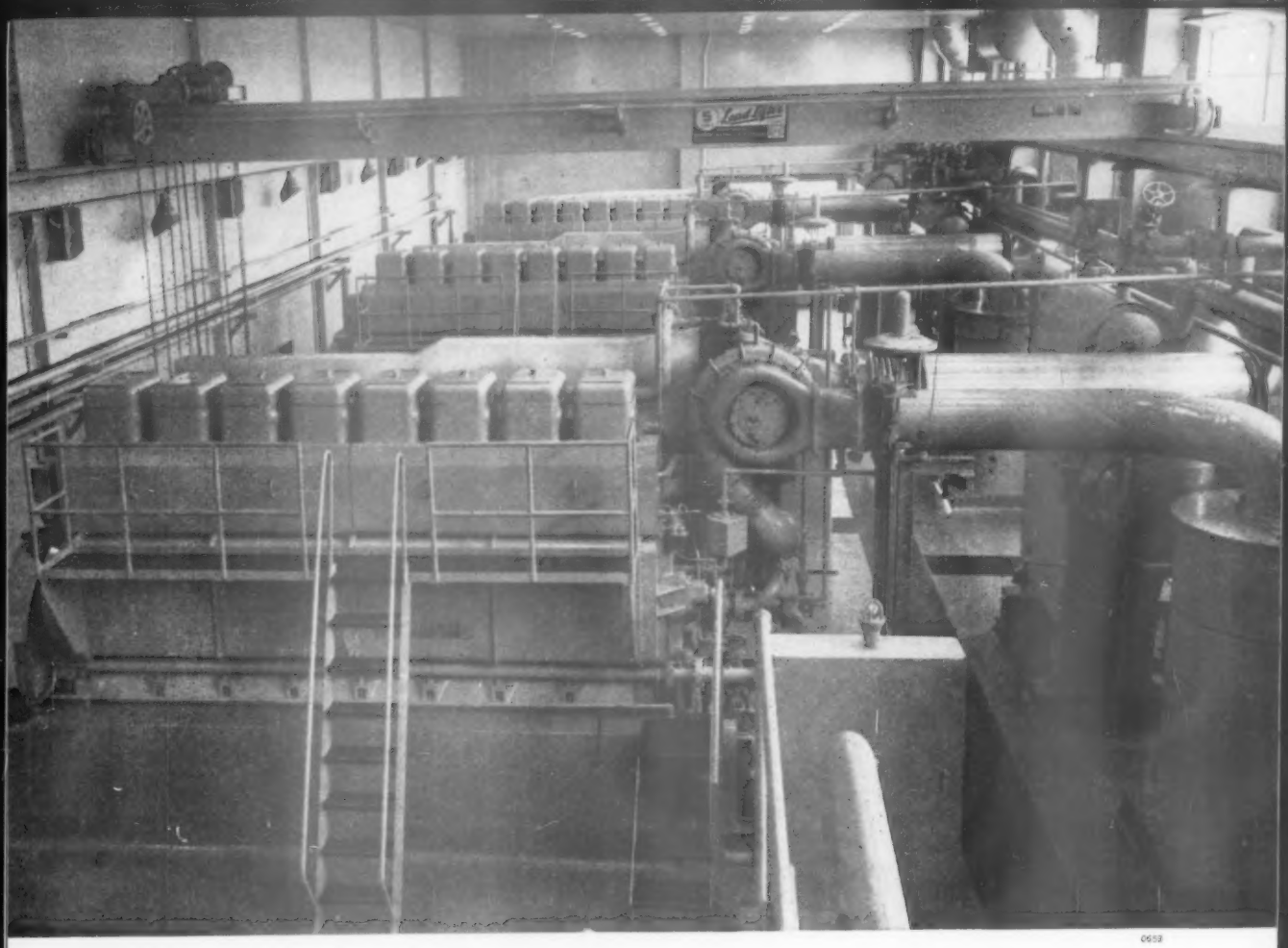

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Pipe line engines by Nordberg

Fourteen Nordberg four-cycle diesel engines, totaling 26,680 horsepower, serve the pumping stations along the Lakehead Pipe Line Company, Inc. line. Eight engines are rated at 2000 hp, and six are rated 1780 hp each. The pipe line extends from the Canadian border to Superior, Wisconsin, and from there to the Canadian border at Sarnia, Ontario.

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highly effective, is a laboratory sample and is not commercially available. It was, therefore, not studied exhaustively.

In general the vegetable-gum compound is superior to starch or the starch-bentonite mixture for controlling fluid loss, although starch was found superior at 190° F.

Pregelatinized starch used alone is effective in 0.15% concentration. The addition of as little as about 0.05% bentonite approximately doubles its effectiveness. Consequently, a mixture of the two is recommended for use over starch alone. The optimum concentration of the vegetable gum compound is 0.05%.

Small additions of the finely divided solids make both starch and gum more effective in fresh water. In brine, however, the vegetable-gum compound is a moderately effective flocculating agent and tends to be removed by contaminating solids. This can be disadvantageous. However, the gum can be used for two purposes if it is desired to clarify brine prior to use. After clarifying, a second addition of gum can be made for controlling fluid loss. Starch has very little tendency to flocculate solids and, therefore, may be preferred when there is danger of contamination by solids.

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BOOK

MINERALOGY AND GEOLOGY OF RADIOACTIVE RAW MATERIALS. By E. W. Heinrich. Published by McGraw-Hill Book Co., Inc., 330 West Forty-second Street, New York 36. 654 pp. $14.50.

A pioneer in its field, this book represents the first attempt to gather together the enormous volume of factual and theoretical information that has appeared on radioactive minerals and their deposits since the exceedingly intensive study of uranium and thorium began in the late 1940's.

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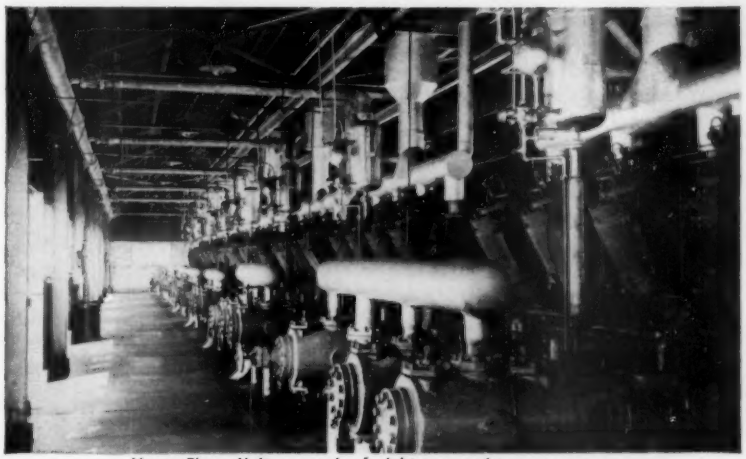

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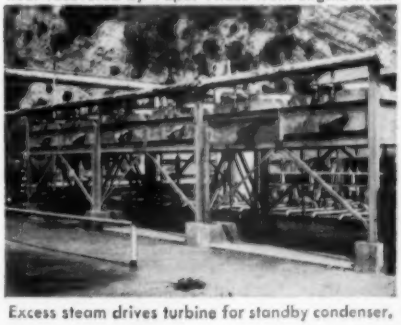

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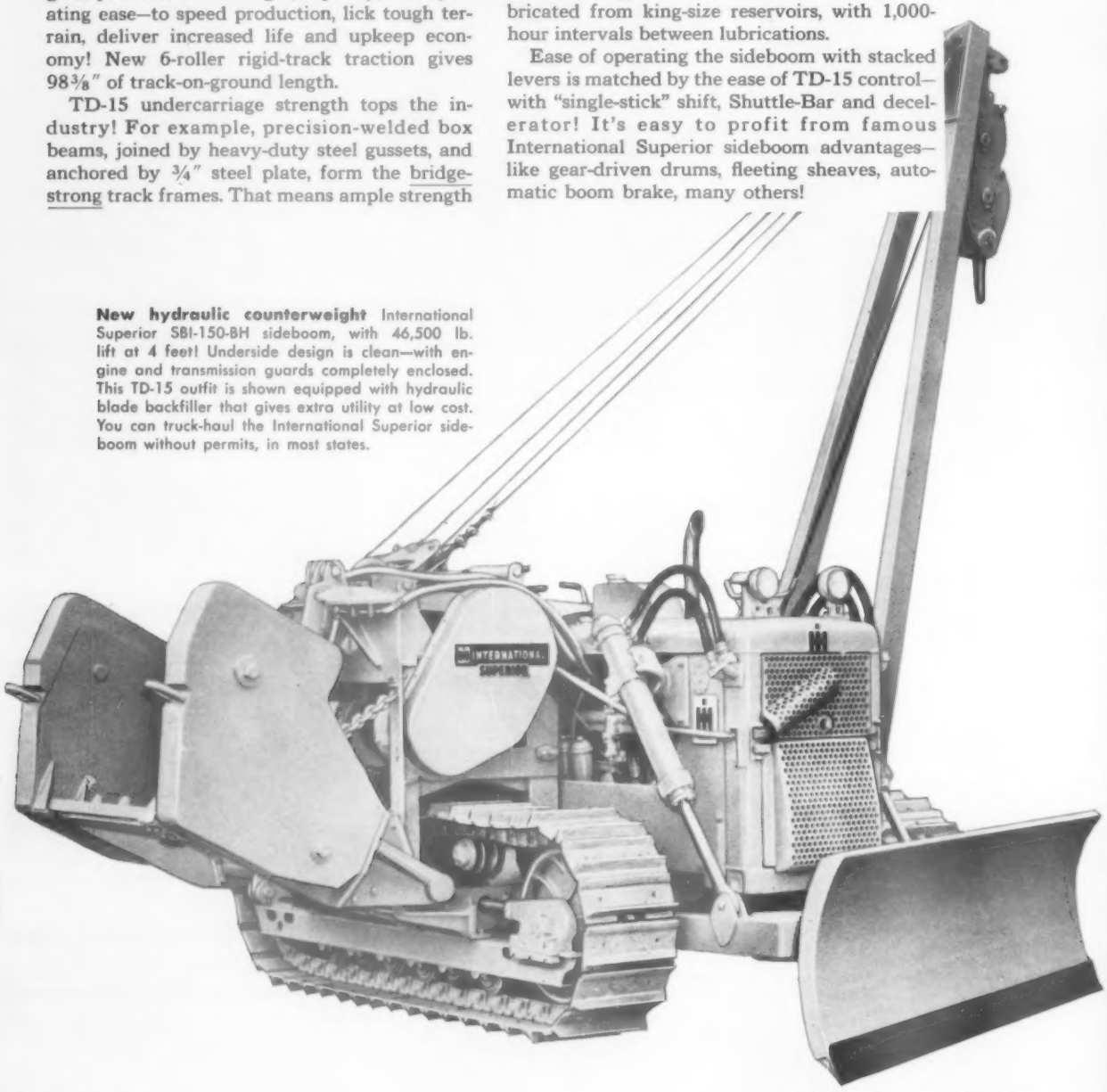
Heavy-duty TD-15 track rollers defy oil field grit and shock—with precision-lapped, metal-to-metal seals; deflection-proof big-diameter shafts; heavy, press-fitted bronze bushings; lubricated from king-size reservoirs, with 1,000-hour intervals between lubrications.

Ease of operating the sideboom with stacked levers is matched by the ease of TD-15 control—with "single-stick" shift, Shuttle-Bar and decelerator! It's easy to profit from famous International Superior sideboom advantages—like gear-driven drums, fleeting sheaves, automatic boom brake, many others!



New hydraulic counterweight International Superior SBI-150-BH sideboom, with 46,500 lb. lift at 4 feet! Underside design is clean—with engine and transmission guards completely enclosed. This TD-15 outfit is shown equipped with hydraulic blade backfiller that gives extra utility at low cost. You can truck-haul the International Superior sideboom without permits, in most states.

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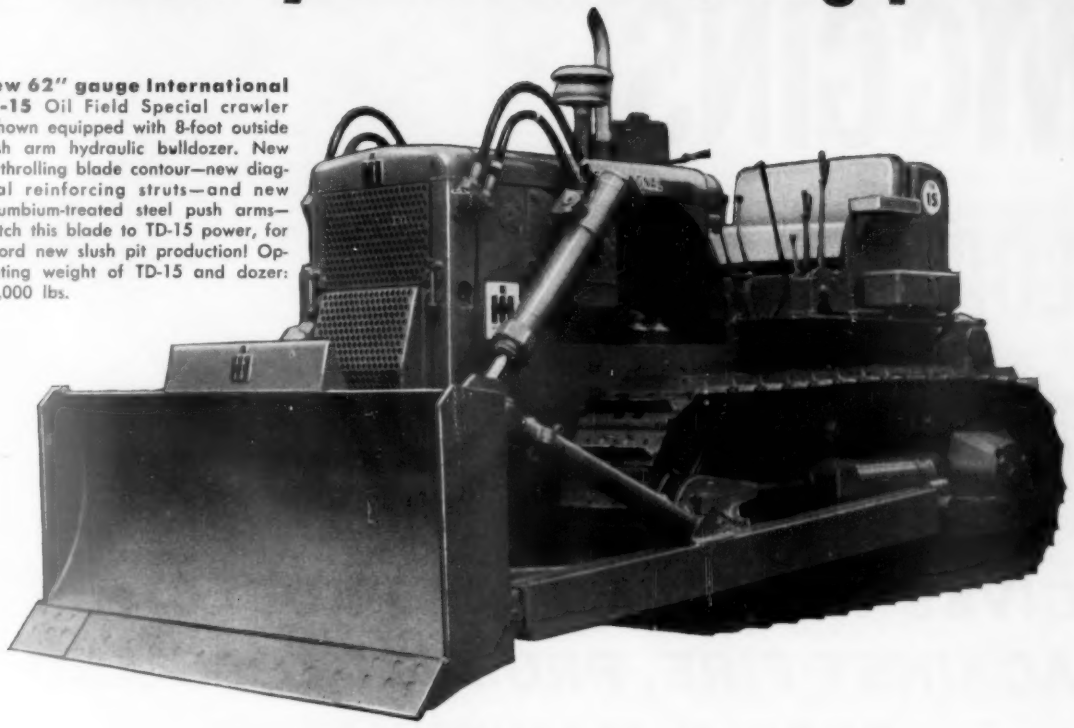

New 62" gauge International TD-15 Oil Field Special crawler —shown equipped with 8-foot outside push arm hydraulic bulldozer. New earthrolling blade contour—new diagonal reinforcing struts—and new columbium-treated steel push arms—match this blade to TD-15 power, for record new slush pit production! Operating weight of TD-15 and dozer: 26,000 lbs.

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Yet maximum overall width of only 8' eliminates need for highway haulage permit in most states!

Prove big capacity 105 hp. TD-15 performance on your contracts! See how new TD-15 powered and mounted sidebooms and dozer can boost your profits. Compare TD-15 advantages—smooth, high-torque 6-cylinder power; full-reverse transmission, with 6 oil-field-job-matched speeds; Shuttle-Bar forward-reverse control; dry-type sintered metal faced engine clutch. See your International Superior Distributor for a demonstration.

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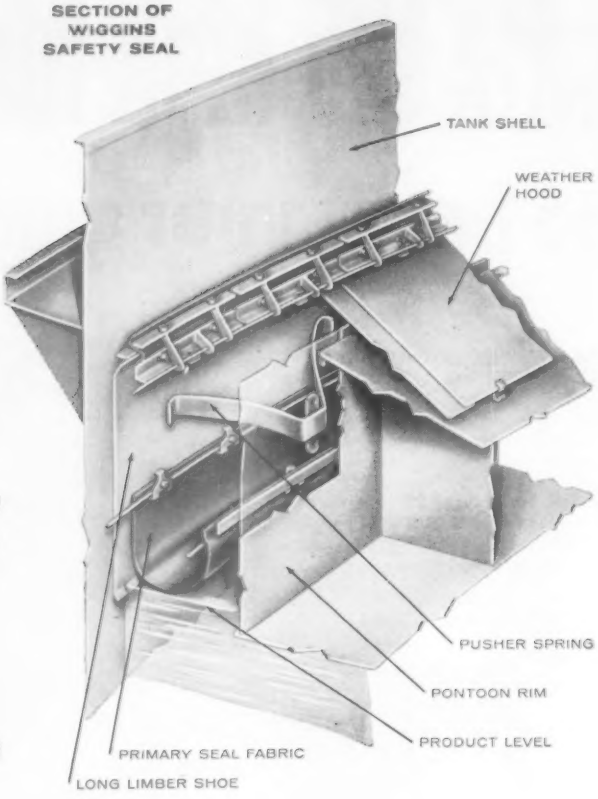

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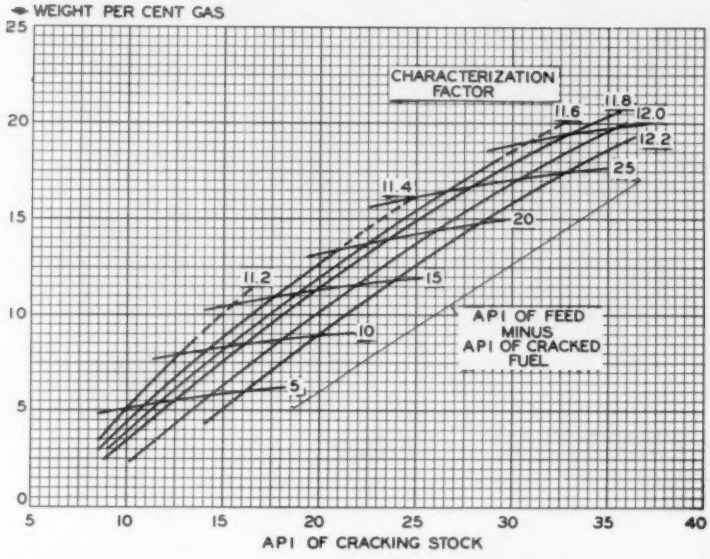


GAS YIELDS when vigorously thermally cracking straightrun distilled or residual stocks for 10-lb. R.v.p. gasoline. Fig. 1.

Gas loss in thermal cracking

In using the yield equations in your Petroleum Refinery Engineering, the yield of gas is stated only as that "unaccounted for" material that makes the liquid volume per cent total to 100%. How can we get this to a weight per cent basis? R.G.T.

In using the charts and equations of Petroleum Refinery Engineering (fourth edition, McGraw-Hill Book Co., Inc., N. Y., 1958) it is necessary to make weight balances and these require time and experience. Accordingly, Fig. 1 on this page presents such material balances for conditions of most vigorous thermal cracking. Although the viscosity of the cracked residue is the vital factor in determining yields, the thermal cracking process is about to be discarded and we have not yet been able to introduce viscosity as the criterion of yields. Because of the lack of adequate viscosity data, it has been necessary to use the gravity of the cracked fuel oil as the factor that governs the yields, or severity of cracking, and this has been incorporated in Fig. 1 by the lines labeled "Gravity of Feed minus Gravity of Cracked Fuel." No lower gravities of cracked fuel oil than those shown in Fig. 1 can be produced without obtaining a cracked residuum that is too viscous (above 300 Furol viscosity at 122° F. after cutting back) to be readily marketed.

Gasoline and fuel-oil yields corresponding to the gas losses of Fig. 1 can be obtained with ease from the charts and equations of Petroleum Refinery Engineering because they are all based on the degradation or severity factor used in Fig. 1, namely "Gravity of Feed minus Gravity of Cracked Fuel."

Conversion of weight per cent to gas volume presents difficulties because the composition of the gas (or its molecular weight) cannot be predicted with accuracy. However, the heat of combustion of the gas can be estimated with reasonable accuracy because the heating values of the various components on a pound basis is fairly well defined (23,920 B.t.u. for methane to 21,340 B.t.u. for butane). Thus the heating value of cracked gases usually ranges from 21,400 to 23,300 B.t.u. per lb. with an average of about 22,320. Amount of hydrogen (61,400 B.t.u. per lb.) and methane (23,930 B.t.u.) are the cause of the highest heating values. Using these figures, the heating value of the gas produced from 1 bbl. of feed stock is about:

	B.t.u.
5% gas	380,000
10% gas	738,000
15% gas	1,050,000
20% gas	1,325,000

Questions on TECHNOLOGY

This department was created for the purpose of aiding managers, superintendents, engineers, chemists, and others engaged in various phases of plant operation, as well as those connected with the marketing and utilization of petroleum products. Readers are invited to send their problems to W. L. Nelson, technical editor. Inquiries must be signed, but only the initials will be printed.

How harmful are metals?

How much metal contaminant can be tolerated in catalytic feed stock and which metals are the worst?—R.W.T.

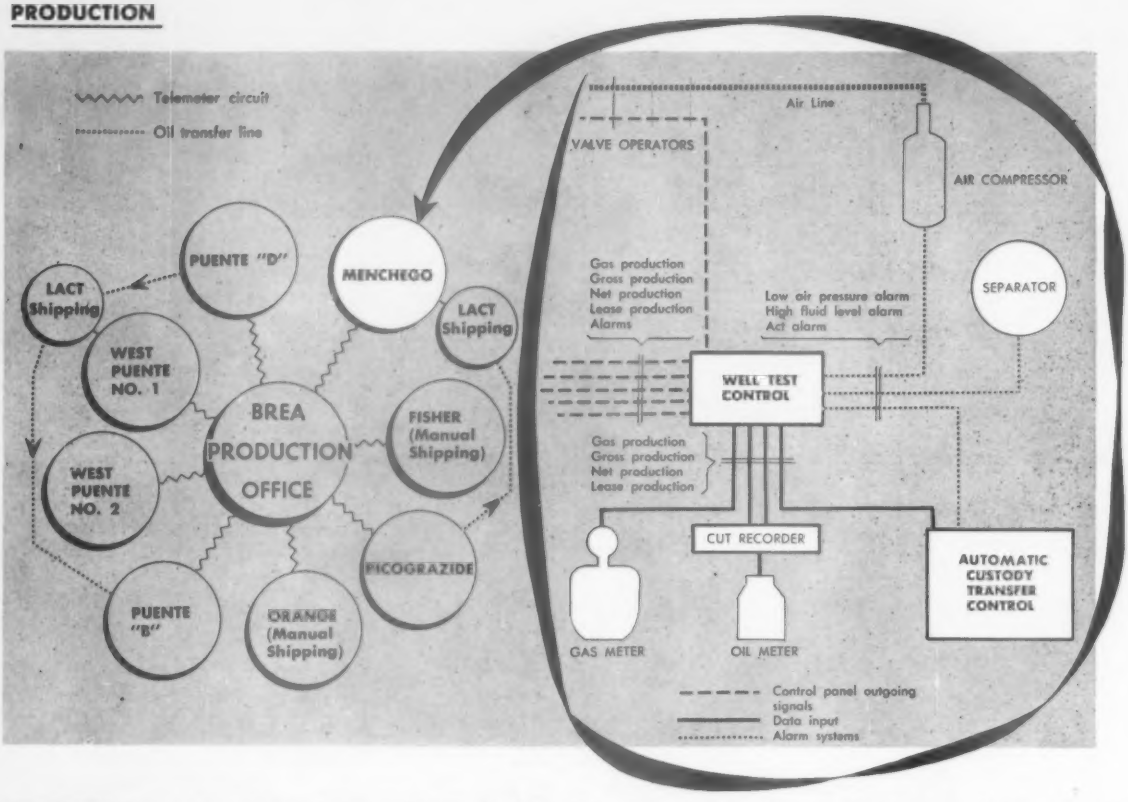
An exact answer cannot be given by this department and it appears that operators and contractors are not certain of how much metal contaminant can be tolerated.

However, generalities in the literature indicate that nickel (among the elements ordinarily reported) is probably the most harmful, followed by copper and then by vanadium and iron. Three opinions or rules have been stated in the literature (see Petroleum Refinery Engineering, fourth edition, pages 782-783, McGraw-Hill Book Co., New York, 1958) and they indicate the following: Iron is used as the basis (1.0) and the other metals are worse:

	(1)	(2)	(3)	(4)*	Avg.
Ni	10.0	5.0	14.0	8.0	9.2
Va	1.0	1.0	4.0	2.0	2.0
Cu	10.0	1.0	1.0	..	4.0
Fe	1.0	1.0	1.0	..	1.0

*Nickel is stated as 3.3 to 5 times worse than vanadium.

Most generally, and still using iron as a basis (1.0), the sum of the p.p.m. of Fe, plus 4 times the p.p.m. of Cu, plus 2 times Va, plus 9.2 times Ni, should not exceed about 4.0. Thus an oil that contains 1.0 p.p.m. Fe, 0.1 p.p.m. Cu, 0.5 p.p.m. Va, and 0.3 p.p.m. Ni would give a total of about 5.2 and this would indicate rapid contamination of fluid-type catalyst. Far larger amounts of contaminants can be tolerated with the bead catalyst used in the Thermofor and Houdriflow processes. One contractor estimates that 1 lb. of nickel in the feed stock to a fluid catalytic cracking plant costs about $1,000 in catalyst replacement.



HOW DATA from automatic trap farms and LACT shipping points are telemetered to Shell's Brea production office is schematically diagramed here. That at right shows how the various alarms and gas-measuring devices feed data to the lease control panel for transmission to the field office.

Telemetering aids Shell's lease operations at Brea-Olinda field

Trimonthly checks on wells provide close records on their performance

A NEW data-collecting system is giving Shell Oil Co. much more information on producing wells at its properties in Brea-Olinda field near Los Angeles.

There the oil and gas daily rates from more than 200 wells are collected at 7 trap farms. The oil is shipped through two LACT systems or is manually shipped at two other points.

All of the installations at intervals telemeter well-test and shipping data into the field production office. The data accumulate on counters at the trap farms and shipping stations. Should a malfunction occur at an installation, the field office is alerted within minutes.

Reliability is the chief aim of the control system, which is all electric except for pneumatic valve actuators that shift wells in and out of test. How well the goal has been realized is shown by the fact that reliability is expected to exceed 99%. In keeping with the trend toward greater automation, the system is designed to be fail-safe.

Automatic well testing . . . Each of the 7 trap-farm control systems at Brea-Olinda is designed to handle 32 wells. At one farm there are two installations, making a total of eight control panels. The system is schematically illustrated in the accompanying diagram.

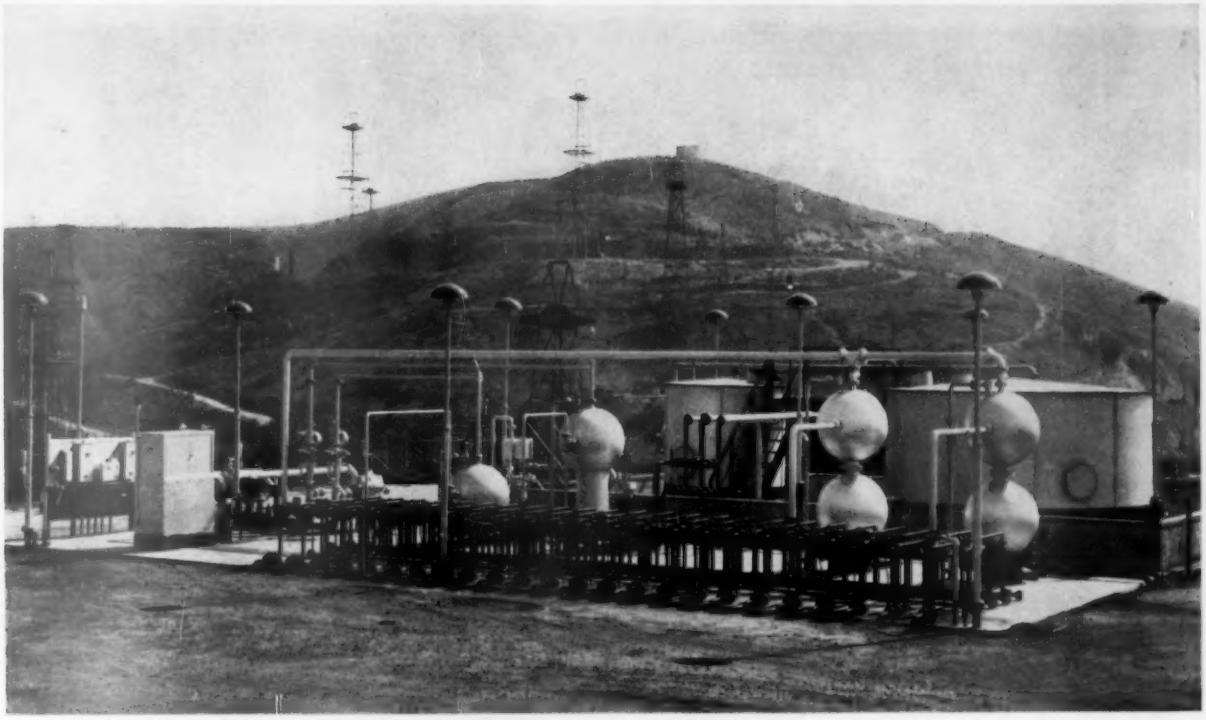
At each installation, wells are diverted from a bulk manifold to a test header at a preset frequency and sequence. This is accomplished by

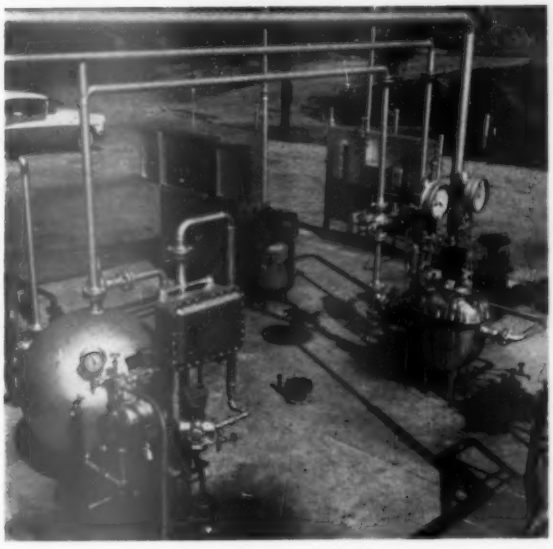
BY D. H. STORMONT
District Editor

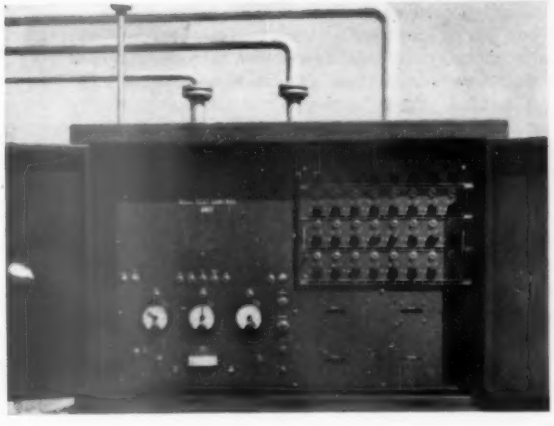
means of air rams which operate three-way valves. The period of time a well is on test is preset for 8, 12, or 24 hours. At the conclusion of the test period the well switches to the bulk manifold and another takes its place on test.

Whenever desirable, panel controls can be set so the trap is purged. This assures more accurate tests when the water cut of the well differs widely from that of the preceding well.

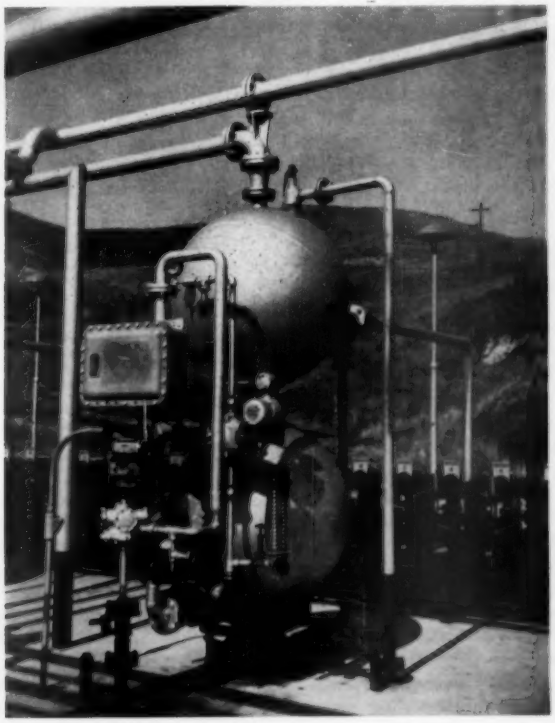
While a well is on test its gross oil production is metered and registered on a counter; likewise its gas production. Net oil production also

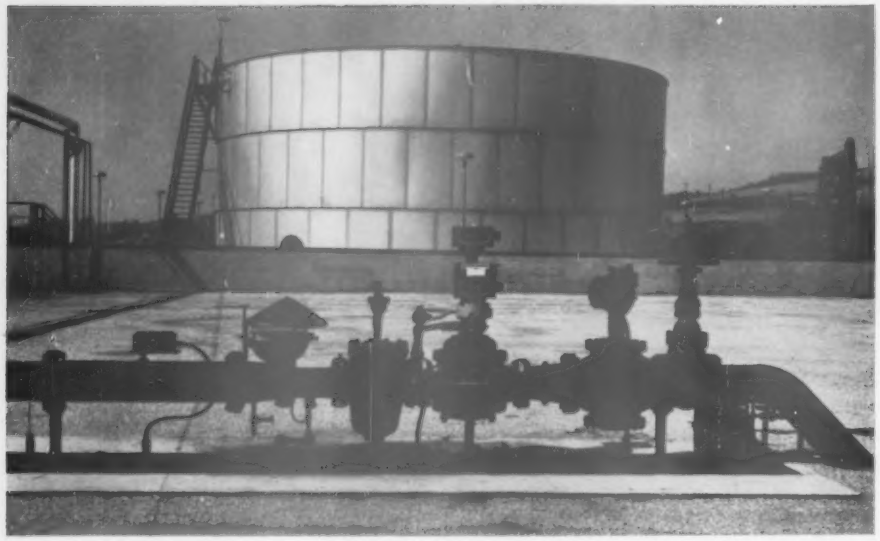






TRAP FARM, one of seven of Shell's Brea-Olinda properties is seen above. Left: Metering of a well's fluid output and percentage water cut (left) is carried out at each trap farm, as well as the gas production (right). Data are accumulated on the control panel in the rear. Bottom, left: Each well test control panel is designed to handle 32 wells. Below: A new computing-type cut recorder, mounted above the oil meter, gives net oil production of a well while on test.





AT TWO LACT systems, the shipping temperature of the crude, per cent cut, and volume shipped is automatically carried out. Below, Shell Engineer Ken Hartwein checks operation of the manual valve operation at one Brea-Olinda LACT unit. Signal lamps which indicate cause of any malfunction include high tank level, high sample line pressure, excessive water cut, and meter failure.

is registered on the well control panel. The amount of net oil is determined through a cut-determining mechanism which also shows the per cent b.s. and w. on a panel indicator.

The oil-production counters reset to zero each time another well is shifted into the test manifold. Should a test be interrupted for some reason or other, the counters start up where they left off and continue until the full test period is completed.

Regardless of whether the well is on 8, 12, or 24-hour test, its oil production is registered in barrels daily. This is accomplished by means of a pulse generator driven by the oil meter. For each 0.1 bbl. measured, one, two, or three impulses are sent to the counter according to the length of the test period. The period of time a well has been on test is shown on one of three clocks. Indicator lights mounted above the three clocks show which one is in operation.

The computing type cut recorder used was developed by Shell Development Co. The electrically operated unit uses a dielectric cell to measure the dielectric constant of the well fluid. Output of the cut recorder is net oil production.

The order and period of test of individual wells are preset but they may be changed at will. As all wiring in the well selector panel is based on a "patch board" arrangement, it takes only about 15 minutes to change the well sequence. If for any reason it is desired to manually gage a well the entire sequence can be interrupted and then resumed.

Wells not being tested flow into either a wet or clean oil bulk production manifold as their water cut dictates. After the oil is dehydrated

it is daily pumped from one of four shipping points, two of which are of the LACT type.

Small tanks are provided at the seven trap farms for testing of new wells and for periodic meter proving. Though they were installed during the period the automatic system was being developed, and the tanks also make it possible for long manual well tests to be carried out when it is so desired. The oil flow is run through the manually controlled manifold, leaving the automatic manifold free to periodically test the other wells connected to the trap farm.

... **Automatic custody transfer** is provided at two shipping stations (located next to automatic well-test stations) where Shell's pipeline department takes over the crude. There the crude is dehydrated before being shipped. As shipping and receiving are carried out simultaneously from a single tank, amount of storage provided is little more than that needed for a safe working margin.

As it is shipped the oil is metered, a continuous sample taken on a volume basis, and the temperature and per cent water cut are measured. The latter two are continuously recorded on strip charts mounted on a nearby control panel. The amount of oil shipped accumulates on a register installed on the well-control panel.

... **The alarm system** incorporated into the well-test and LACT systems monitors allied electrical and mechanical equipment as well as providing a warning that a malfunction has occurred. A red light at the installation glows whenever something has gone wrong. The telemetering system with-

ALL WELL TEST DATA and shipping information are printed out at this receiver in the field production office.

SHELL OIL COMPANY

BREA DISTRICT

DAILY WELL TEST REPORT

DATE	TIME	WELL ID.	GROSS B/D	CLEAN B/D	GAS MCF/D	% CUT	CHECK
02/23/59	09:18P	A3-01	065.9	023.9	019.0		
02/23/59	10:34P	B-04	054.5	025.7	002.9		
02/23/59	11:05P	H-14	026.2	015.2	033.4		
02/24/59	12:13A	MENCHEGO WT					
02/24/59	12:17A	MENCHEGO WT					
02/24/59	12:21A	MENCHEGO WT					
02/24/59	12:25A	MENCHEGO WT					
02/24/59	06:39A	J-16	024.4	016.8	000.0		
02/24/59	09:26A	MENCHEGO LP A 00500					
02/24/59	09:30A	MENCHEGO LP					
02/24/59	09:34A	MENCHEGO LP					
02/24/59	11:40A	K-19	142.0	120.1	040.0		
02/24/59	01:40P	MENCHEGO LP A 02000					

TYPICAL REPORT of well test and shipping data as received at the field production office.

in 4 minutes alerts the production office, as discussed later on.

Compressed air for switching wells in and out of the test manifold is supplied by small air compressors. In the event air pressure drops too low, this condition is made known by local and remote alarms. As the system is fail-safe, wells switch from test to the bulk manifold in the event of a power failure. The latter causes a well test to be suspended but as soon as power is restored, testing is resumed as if nothing had occurred.

At the two LACT systems a power failure likewise causes shipping to stop. However, in this case it is necessary for the pumper to visit the installation and push a reset button in order to start the pump again.

Another well-testing malfunction which may occur is the fluid level building up too high in the test separator. When this happens the alarm system is actuated and a safety switch operated. This results in the test well's fluid being bypassed through the bulk production trap, avoiding the danger of oil getting in the gas line. Again when normal conditions are restored, testing goes on as if the interruption had not occurred.

Alarms associated with the LACT systems include the following: High tank level, high sample line pressure, excessive water cut, failure of the continuous sampler, failure of the motor-driven valve in the discharge line, and insufficient flow rate or meter failure. When any one of these occurs, a warning light above the control panel is illuminated as well as an indicating lamp on the LACT control panel and one on the well-control panel (see photo). The field office is alerted that something has gone wrong by means of the well-control panel.

Telemeter system . . . As is shown on the accompanying schematic diagram, all well-testing and shipping data are telemetered to the field production office. There the data are printed out.

The system makes use of standard telemetering devices, with resonant reeds as the means of establishing contact between the receiver and transmitter. Each of the trap farms is keyed to a different frequency. Whenever its required frequency is sent out from the central office, each farm automatically locks into the system. Any accumulated data then are transmitted if a well test has been completed, a LACT unit has finished shipping, or an alarm condition exists. If none of these exist the connection is automatically broken after 30 seconds. Under current operations every installation is quizzed at 4-minute intervals but the period can be changed if desired.

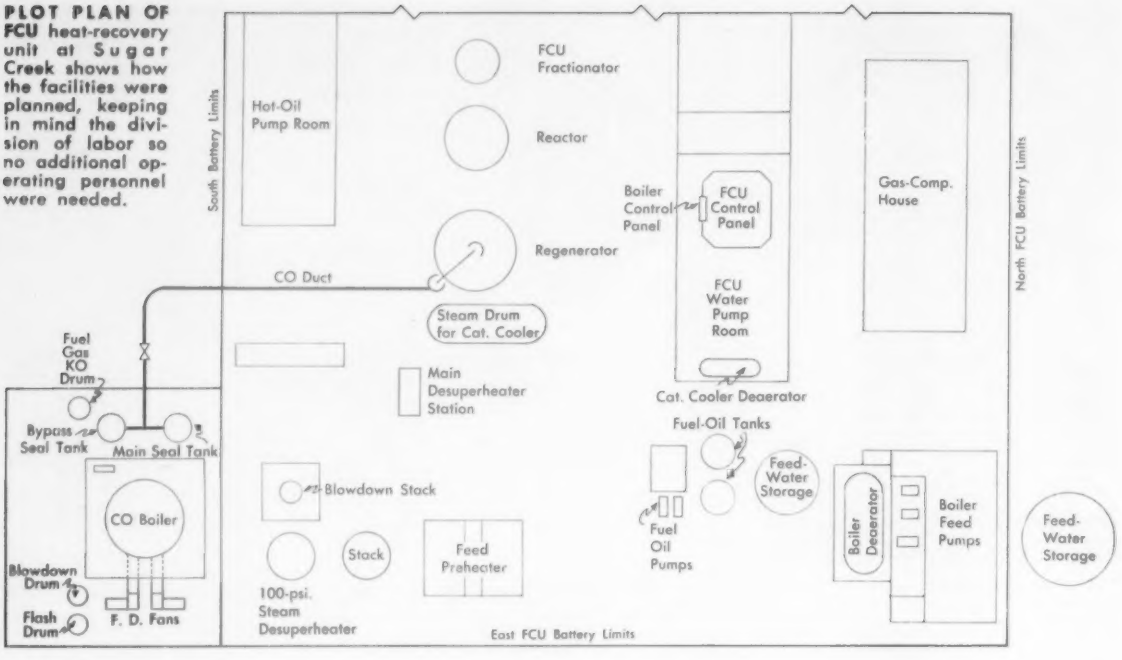
The form in which the data are recorded is shown in an accompanying illustration. The data shown are based on actual records, with the well identification changed and the time period altered in order to condense the information.

Data telemetered in whenever a well test is completed consist of the well name and number, gross and net oil production in barrels daily, and the gas production in M.c.f. daily. An extra column is provided on the report for computing the per cent cut. Insofar as the two LACT systems are concerned, only data telemetered to the Brea office are the amount of oil shipped and any alarm conditions.

How the telemetering system serves as a monitor on field operating conditions is indicated on the typical report. As shown, test data from three wells had been received when shortly after midnight a malfunction occurred at the Menchego trap farm. In this case the situation cleared itself, whatever the cause, and the well test was resumed within 20 minutes.

Later in the morning another malfunction occurred at the Menchego LACT unit, causing pumping to stop after 500 bbl. of oil had been shipped. As is the case whenever a malfunction occurs, the lease (or well test) name was repeated at 4-minute intervals until the pumper corrected the situation. The last entry on the report shows that 2,000 bbl. more oil had been shipped from the Menchego lease following the malfunction.

Based on the few months it has been used, the equipment is expected to give reliable service with a minimum of preventive maintenance. The system provides for each well to be tested at least three times monthly. This of course results in more complete information on how individual wells are performing.



PLOT PLAN OF FCU heat-recovery unit at Sugar Creek shows how the facilities were planned, keeping in mind the division of labor so no additional operating personnel were needed.

CO boiler supplements refinery steam supply

Production of steam at minimum cost by burning the carbon monoxide and making use of sensible heat in regenerator flue gases was the goal involved in the installation of an additional 250,000 lb. per hour of steam-generating capacity.

BY H. H. FORGEY AND T. E. KOBETT
Standard Oil Co. (Indiana)
Sugar Creek, Mo.

TO SUPPLY the need for additional steam capacity at our Sugar Creek refinery, a CO boiler was installed for operation on the regenerator flue gas from the existing fluid catalytic cracking unit (FCU). The installation, which includes a Babcock Wilcox CO boiler, was designed and constructed by Stearns-Roger Manufacturing Co. This facility was designed for a regenerator-gas temperature entering the CO boiler of 1,000° F. and a flow of CO-bearing flue gas of 422,480 lb. per hour. The unit has been in operation since December 1957.

The CO-boiler installation consists of an outdoor heat-recovery steam-generating unit. Flue gas from the FCU regenerator is supplied to a cylindrical water-cooled furnace where supplementary fuel (refinery gas or oil) is also burned to maintain a minimum furnace temperature of 1,500° F. to insure stable ignition of CO-bearing gas.

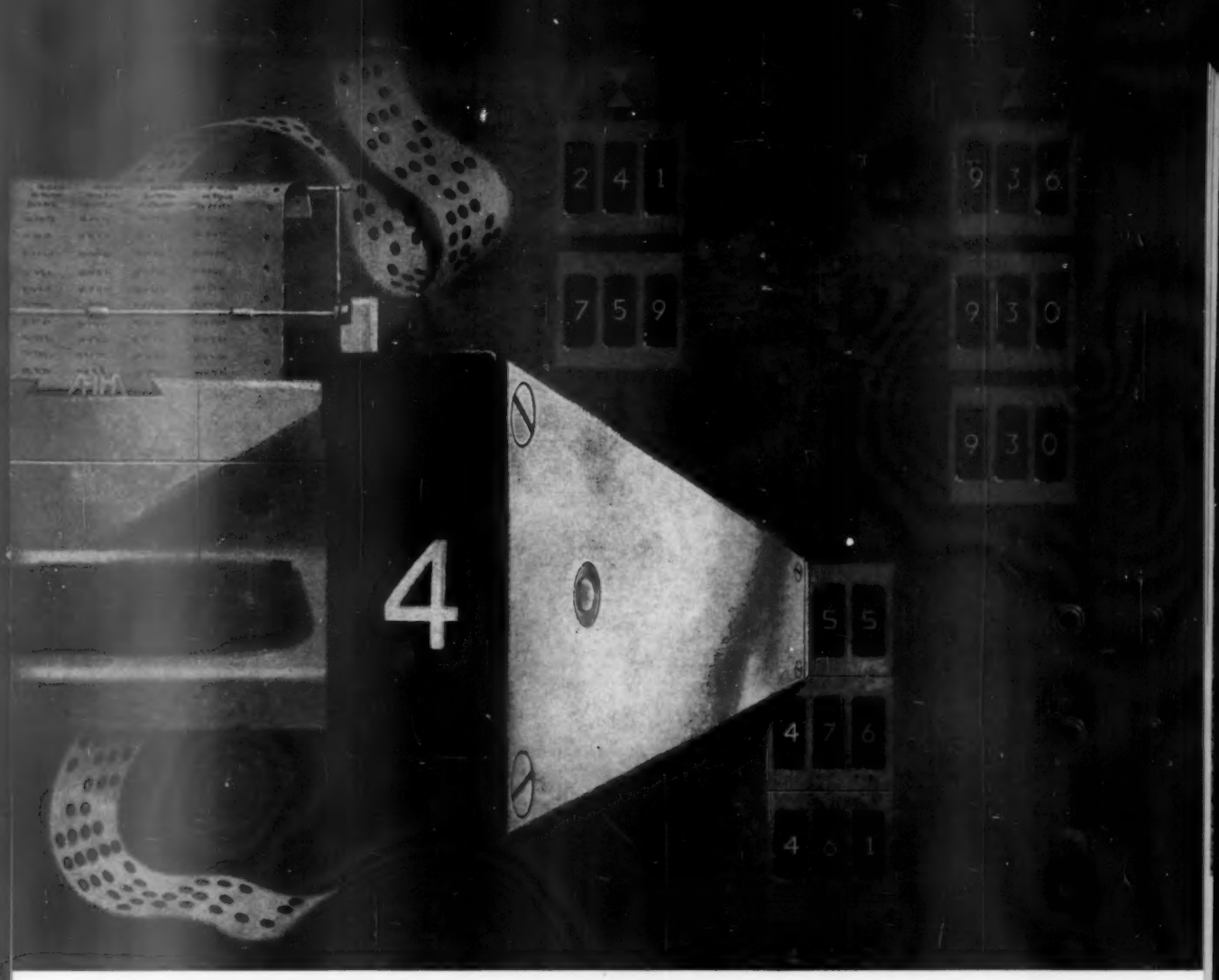
This heat-recovery unit can generate a maximum of 250,000 lb. per hour of steam. When regenerator flue gas is not available, the supplementary firing rate may be increased to enable the unit to produce a maximum of 201,000 lb. per hour of steam.

No refinery process changes were necessary. Major items in the installation, in addition to the boiler proper, were a CO gas duct with a double-gate slide valve and two water seal tanks. A small control panel was added in the FCU control room. The boiler feed-water pumps and fans can be started or stopped from the control room. Sufficient automation and controls were provided so that no additional manpower is required to operate the system. Automation is complete to the extent that even soot blowing is remotely controlled through a sequential timer. A fuel-and-fan interlock is included among the safety features of the heat recovery unit control system.

1. WHY INSTALL A CO BOILER?

Alexander and Bradley[1] have summarized the reasons for installing a CO boiler when additional steam capacity is needed in a refinery.

... Benefits. Ordinarily the fluid catalytic cracking unit is of such a size that a large quantity of high-temperature gas is available in the form of regenerator flue gas. At least part of the sensible heat can be recovered. There are also varying



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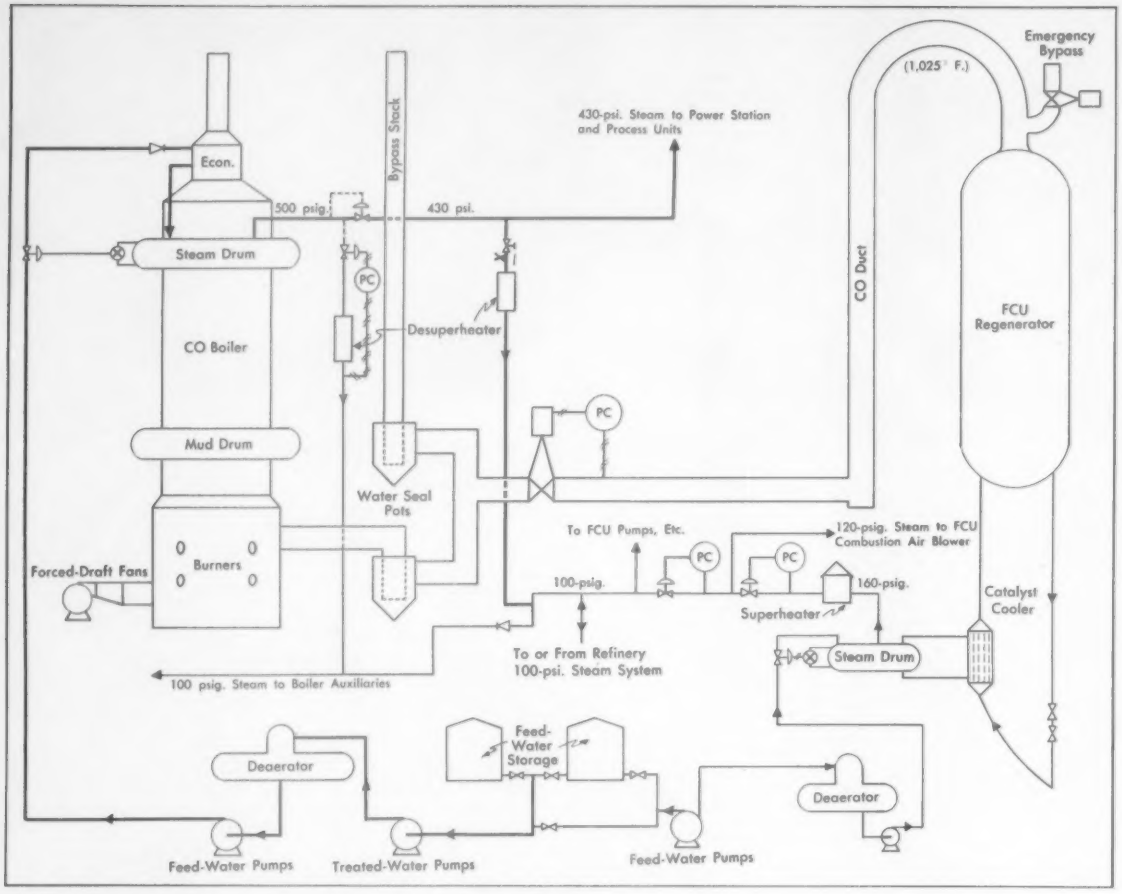


FCU steam-generation facilities at Sugar Creek refinery of Standard Oil Co. (Indiana). CO boiler makes a maximum of 250,000 lb. per hour of steam.

amounts of combustibles in the regenerator gas. These consist of CO primarily, with some entrained hydrocarbons. A CO boiler can be designed to use virtually all the heat of combustibles for steam generation. Thus the over-all plant thermal efficiency often can be improved. A corollary benefit is the reduction of air pollution.

. . . History. The economics, etc., for the first CO boiler, which was installed at Sinclair Refining Co.'s Houston refinery, were reviewed by Campbell and Pennels.[2] Later the first cylindrical CO boiler, with a high primary furnace temperature, was installed at Sinclair's East Chicago refinery.[3,4] There are now nearly three dozen CO boiler units operating or being built in the United States and elsewhere (see table).

What's the payout? . . . As noted by Alexander and Bradley, "there are minimum capacities, flue gas temperatures, fuel values, etc., which determine the economic desirability of a CO boiler for a specific refinery". These authors have charted correlations from which payout of a CO boiler can be estimated. The generalized charts give minimum steam production and payout of CO boilers, and show effect of CO_2/CO ratio, regenerator flue-gas temperature, variable fuel cost, and per cent O_2 in regenerator gas—all as related to coke-burning capacity of the FCU.

Alexander and Bradley made the following general conclusions:

1. A coke-burning rate of 11,000 lb. per hour or higher makes a CO boiler installation attractive, assuming additional refinery steam is required (existing steam generation facilities not to be retired) and assuming the fuel has a value of 20 cents per million B.t.u.

2. Minimum coke-burning rate to provide reasonable payout on a CO boiler is about 18,000 lb. per hour when additional steam is not required (existing steam-generation facilities to be replaced).

3. There is small economic incentive to investigate a CO boiler if coke-burning range is much below this range, unless a refiner wishes to minimize auxiliaries.

2. SUGAR CREEK INSTALLATION

The Standard Oil Co. (Indiana) refinery at Sugar Creek, Mo., has a throughput capacity of 80,000 bbl. per stream day. The FCU has a total feed capacity of 35,000 bbl. feed per stream day. Products of combustion from coke burning in the regenerator give a ratio of CO_2/CO of 1.2/1. A typical Orsat on the regenerator gas shows:

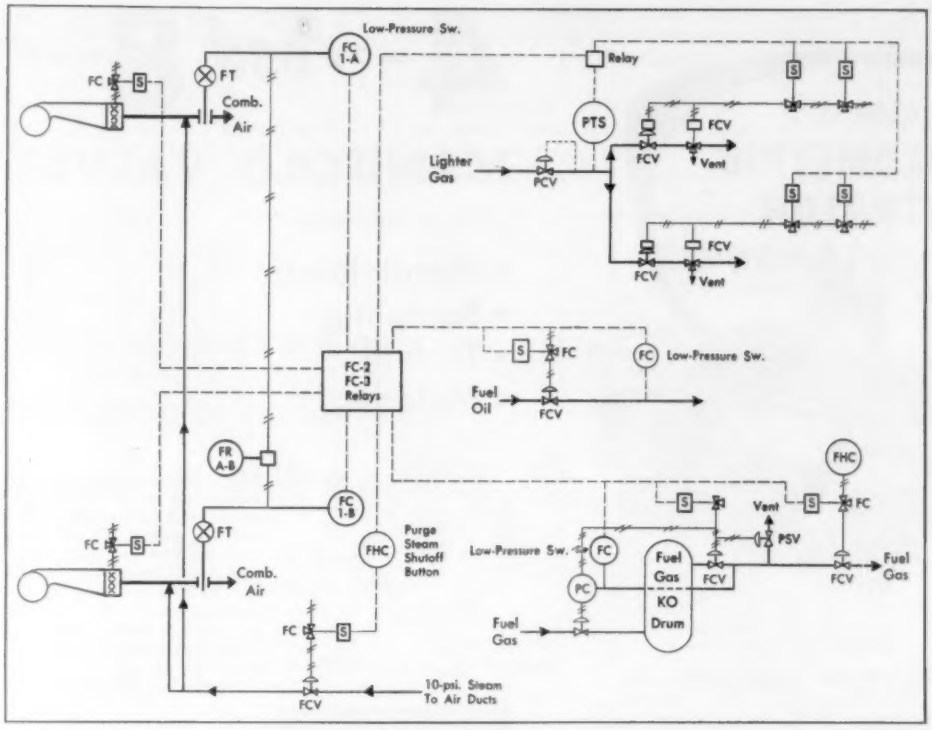
	(%)
CO_2	10.4
O_2	1.0
CO	8.6

Regenerator gas temperature runs typically at 1,025° F. CO boiler flue-gas temperatures are:

	(°F.)
Primary furnace	1,600
Secondary furnace	1,400
Economizer inlet	700
Economizer outlet	460

Other pertinent data:

Steam pressure (superheater outlet), psig.	510



FUEL-AND-FAN SAFETY INTERLOCK. Here's how it operates: (1) If combustion air flow gets too low (fan failure) switches FC-1-A and B close, energizing relays FC-2 and 3. This opens steam purge to air ducts, blocks and vents fuel gas, blocks off fuel oil, and blocks and vents lighter gas. (2) Low pressure on any of the three fuel systems causes interlock to close down that system independently.

Steam flow, lb. per hour	250,000
Steam temperature, °F.	650
Feed-water temp. to economizer, °F	255
Feed-water temp. from economizer, °F.	415
Supplementary fuel, M.M. B.t.u./hr.	132
CO gas combustibles-plus-sensible heat, M.M. B.t.u./hr.	248

. . . Heat recovery. Above figures indicate that some 35% of total heat is obtained from burning supplementary fuel when running at the maximum steam-generating capacity of 250,000 lb. per hour. The unit was designed for recovery of approximately 50% of sensible heat and 100% of heat of combustibles. Alexander and Bradley have noted that entrained hydrocarbons (which do not appear in the CO gas analysis) account for production of 5 to 10% more steam than is calculated from the CO analysis. Although operating experience on 10 CO boiler units bears out this observation, this phenomenon has not been noted to this extent on the Sugar Creek CO boiler.

. . . Burner system. CO burns readily at temperatures as low as 1,500° F. in this type of furnace. Combination gas and oil burners are therefore provided to maintain the pressured firebox temperatures above 1,500° F. The primary supplementary fuel is gas; fuel oil is used as pilot and standby fuel. Each burner is provided with a spark-plug ignition system. A selector switch on the panel board is used to set the air/fuel ratio. Fuel oil, when used, is controlled manually. The combustion air required for both supplementary fuel and CO gases is regulated to provide 2-2.5% O_2 at boiler outlet. This is done according to measurements made on stack samples by an oxygen analyzer. If the O_2 in the stack goes too high, the air/fuel ratio setting is changed. There is also a combustibles analyzer to aid in monitoring the operation.

FCU Steam-Generation Unit

Feed-water is stored in two tanks manifolded so that either can supply the CO-boiler steam-generation system or the regenerator catalyst cooler steam system or both.

. . . Feed-water system. Three identical boiler feed-water pumps, one motor and two turbine-driven, are provided for the CO-boiler system. One pump is used up to 201,000 lb. per hour steam production and two in parallel from 201,000 to 250,000 lb. per hour of steam. The third pump is a spare. The boiler feed-water pumps discharge into the economizer section of the boiler. Feed-water flow is controlled by a three-element feed-water regulator through the steam-drum level-control valve, as indicated. (Other control tie-ins are not shown on the abbreviated process diagram).

. . . CO boiler. A condensed description of the main sections follows. The primary and secondary furnaces and boiler tube bank form a single integrated unit, supported from the top with provisions for expansion downward. Allied and auxiliary equipment includes: (1) pressure control system for regenerator, to regulate CO gas flow to boiler, (2) CO gas water seal tanks and bypass stack, (3) supplementary fuel burners, (4) forced draft fans, (5) soot blowers, (6) feed-water controls, and (7) other instruments and controls.

. . . Primary furnace. This section is the critical one with regard to combustion. Here the CO gas, supplementary fuel and combustion air must be thoroughly mixed and burned. The Sugar Creek unit is equipped with 16 CO gas ports arranged in pairs, and with eight supplementary fuel burners.

. . . Secondary furnace. This is located just above the primary furnace

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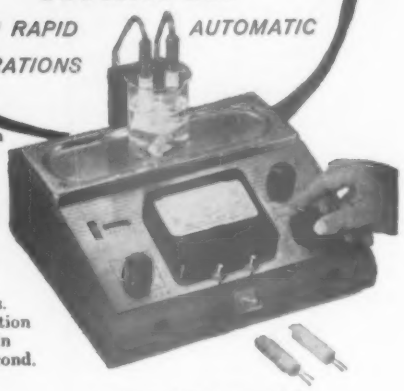

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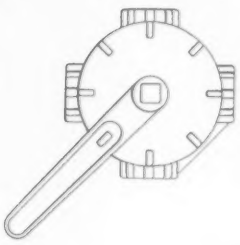

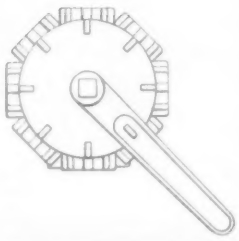

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and provides additional space for completion of combustion. Heat absorption takes place here with gases directed into the superheater and boiler-tube banks.

... **Superheater.** The pendant-type superheater is located in the forepart of the boiler bank and absorbs heat to raise the temperature of the saturated steam leaving the steam drum to about 650° F. at the superheater outlet.

... **Economizer.** This is a convection-tube bank located above the boiler and absorbs heat from outgoing gases for raising the temperature of incoming boiler feed-water. The treated feed-water comes in at the upper economizer header and down through the economizer tube bank to the steam drum. In the boiler and furnace sections there is the usual natural recirculation of water from tubes to steam drum, etc. *(Continued on p. 145).*

PROGRESS REPORT

34 CO boilers are now operating or building for fluid or Houdriflow cats

BY JOHN C. REIDEL
Oil & Gas Journal Staff

IN ITS February 22, 1954, issue The Oil and Gas Journal carried an article by Oliver Campbell and N. E. Pennels on the pioneer CO boiler installation, that of Sinclair Refining Co. at Houston.

Today we list 34 such boilers operating, in conjunction with fluid or Houdriflow cat crackers, or under construction. There are 27 units located on the North American Continent with a total steam-generating capacity of over 6,000,00 lb. per hour. Additional capacity of well over 1,000,000 lb. per hour is located elsewhere (if we include all the Shell Group installations).

Other such installations are being planned and it is expected that more will be erected.

Largest single unit is that of Standard Oil Co. of Ohio at Toledo (450,000 lb. per hour steam generation). This was designed to meet the normal steam demands of the entire refinery. A supplemental medium-sized boiler fired conventionally with fuel gas was erected for startup and to help meet possible peak demands.

Boilers using Oxy-catalyst are operated by Sun Oil Co., one at Toledo and the other at Marcus Hook. The platinum-type catalyst oxidizes combustibles in the regenerator flue gas at relatively low temperatures (gas temperatures entering the catalyst bed is around 850°F).

A large Gulf Coast refinery operates an installation employing two CO boilers, gas turbines, and turbine exhaust-gas feed-water heaters. This equipment operates in conjunction with the refinery's newest FCU in this manner: (1) each gas turbine drives a compressor which delivers air to the regenerator, (2) regenerator flue gas then goes to each CO boiler, (3) meanwhile the high-temperature gas-turbine exhaust goes through the feed-water heaters, and (4) is used as an oxygen source to burn combustibles in regenerator flue gas, and to burn stabilizing fuel in CO boilers.

Use of the FCU regenerator flue gas itself to drive a gas turbine was tested at Shell Oil of Canada, Ltd's., Montreal East refinery. A slipstream amounting to about 10% of total regenerator flue gas was withdrawn for the test, passed through a special separator, and expanded through a turbine. A total of 4,000 hours of operation showed that the separator could remove catalyst particles sufficiently to prevent serious erosion of turbine blades (See article in The Oil and Gas Journal, April 20, 1959).

CO Boiler Installations

North America (U.S.A., Canada, and Mexico)

Company and location—	Total steam* (lb./hr)	Date on stream
British American Oil Co., Ltd.:		
Montreal East, Que.	150,000	.....
Port Moody, B. C.	85,000	.....
Canadian Oil Co's., Ltd.:		
Sarnia, Ont.	100,000	Nov. 1955
Humble Oil & Refining Co.:		
Baytown, Tex.	177,000 each (twin boilers)	July 1958
Imperial Oil Co.:		
Calgary, Alta.	80,000	Dec. 1958
Dartmouth, N. S.	125,000	July 1956
Gulf Oil Corp.:		
Port Arthur, Tex.	400,000	Const.
Petroleos Mexicanos:		
Atzcapotzalco (Mexico City), D. F.	275,000	Nov. 1958
Richfield Oil Co.:		
Wilmington, Calif.	340,000	Aug. 1954
Salt Lake Refining Co.:		
Salt Lake City, Utah	40,000	Summer 1958
Shell Oil Co.:		
Anacortes, Wash.	175,000	.....
Wilmington, Calif.	195,000	April 1959
Sinclair Refining Co.:		
Houston, Tex.	330,000	Nov. 1953
East Chicago, Ind.	275,000	Dec. 1955
Standard Oil Co. of California:		
Richmond, Calif.	275,000	1959
El Segundo, Calif.	275,000	1959
Standard Oil Co. (Ind.):		
Sugar Creek, Mo.	250,000	Dec. 1957
Standard Oil Co. of Ohio:		
Toledo, Ohio	450,000	Aug. 1958
Sun Oil Co.:		
Toledo, Ohio	190,000	Mar. 1954
Toledo, Ohio	†52,500	May 1955
Marcus Hook, Pa.	†52,500	June 1955
The Texas Co.:		
Anacortes, Wash.	260,000	Oct. 1956
Port Arthur, Tex.	350,000	July 1958
Tidewater Oil Co.:		
Avon, Calif.	425,000	Aug. 1956
Delaware City, Del.	425,000	Mar. 1957
Utah Oil Refining Co.:		
Salt Lake City, Utah	138,000	April 1958
	6,067,000	
Overseas		
Cia. Shell‡ de Venezuela, Ltda.:		
Punta Cardon, Venezuela	265,000	June 1957
Idemitsu Kosan:		
Tokuyama, Japan	100,000	Oct. 1957
Esso Standard Oil Co., Ltd.:		
Fawley refinery, England	300,000	Const.
	665,000	

*This is total maximum continuous steam-generation capacity. It includes: (a) evaporation from sensible heat and combustible in regenerator flue gas, and (b) evaporation from supplementary fuel fired.

†These are twin oxy-catalyst boilers, one located at Toledo and the other at Marcus Hook. In this case the capacity listed is based only on the sensible heat and combustible in regenerator flue gas. However, boiler is equipped with conventional furnace and fuel firing equipment for standby and supplementary steam generation.

‡Other CO boilers at Shell Group installations are: (1) Shell Refining & Marketing Co., Ltd., at Stanlow, England, (2) Shell Refining (Australia) Pty., Ltd., at Geelong, Australia, (3) N.V. de Bataafsche Petroleum Mij at Pernis, Netherlands, and (4) N.V. Curacaosche Petroleum Industrie, Mij. at Curacao, N.W.I.

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Seal tanks are provided so that the FCU regenerator can be operated with the heat-recovery unit shut down, the CO gas from the regenerator then being bypassed directly to the stack. The arrangement also is such that the heat-recovery unit can be operated with auxiliary fuel when the FCU is shut down.

Flow of CO gas through these main gas seals can be stopped by filling with water to a level high enough so that the pressure exerted by the water is equal to the CO-gas pressure. The seals are designed for a differential head of 60 in. of water. The CO-gas pressure at the seal is of course determined by the resistance to gas flow of equipment downstream of the seal. The seals are provided with high and low-level alarms.

A pressure of 10-15 psig. must be maintained on the FCU regenerator. For this purpose, the slide valve located in the CO duct between the regenerator and water seal pots is set up as a back-pressure control to regulate the flow of gas from the regenerator. Pressure in the boiler firebox is about 1/2-1 psig.

The boiler unit employs top horizontal discharge forced-draft fans driven by steam turbines and equipped with a hydraulic orifice direct-acting variable-speed-type governor. Drive turbines can be started and stopped locally or from the control panel.

Fan speed is regulated according to steam flow which is tied in with the three-element steam-drum level-control system. If steam flow should decrease, then the air flow from the fan will increase and will, in turn, adjust the fuel-gas flow to hold a set fuel-air ratio, restoring the steam flow.

The fuel gas, fuel oil and igniter gas are tied into the fan system through a double block and bleeder system so that if air flow is lost all three will shut off. Low pressure on any of the three fuel systems will cause the interlock to shut down that system independently. If the pressure drop in either fan duct falls to a preset minimum value, a pair of dampers in the discharge duct from that fan closes. If the pressure drop falls below the minimum in both fan ducts at the same time, the fuel safety shutoff valves are tripped, and a purge steam valve opens automatically to admit steam to the space between the closed dampers in the fan ducts.

Both a main and auxiliary desuperheater station are provided. A maximum of 50,000 lb. per hour of steam may be routed through the auxiliary desuperheater station to supply the mechanical-drive steam turbines for boiler auxiliaries. The pressure-reducing valve opens automatically when the steam pressure in the supply header to the boiler auxiliaries falls below 80 psi. and thus maintains steam pressure to keep the boiler auxiliaries running in case of emergency.

The main pressure-reducing and desuperheating station is manually controlled and is used only at the request of the main Power Station.

References

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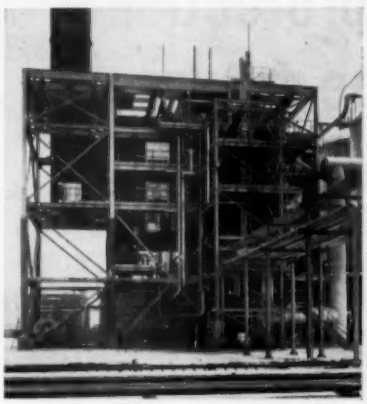
2. Campbell, O. F., and Pennels, N. E., The Oil and Gas Journal, Feb. 22, 1945, p. 132.
3. Campbell, O. F. Paper presented at ASME meeting, Boston, 1955 (The Oil and Gas Journal, Aug. 29, 1955, p. 109.)
4. Pennels, N. E. Paper presented at ASME annual meeting, 1956 (ASME paper No. 56-A-198).
5. Durham, E., and Leland, M. B. Paper presented before Sabine section of ASME at Port Arthur, Tex., March 7, 1956.
6. Trounce, P., and Harvey, T. J. Combustion, August 1958.
7. CO Boilers. (Combustion Engineering Inc., Catalog CO-1 and Babcock & Wilcox Co. Bulletin G-87A).
8. Silva, R., The Oil and Gas Journal, May 7, 1956, p. 115.



NEW FOUR-STORY CO BOILER has just been put into operation by Shell at its Wilmington refinery.

PUSH-BUTTON CONTROL BOARD is a feature of the new $1,250,000 CO boiler unit.

Monument to smog control

PAYOUT was a secondary consideration when Shell Oil Co. decided to install a carbon monoxide boiler at its Los Angeles refinery to burn the waste gases from an existing catalytic cracking unit.

The more than $1,250,000 spent for the new unit will eventually be returned, if all goes well, but it will be a long time in doing so.

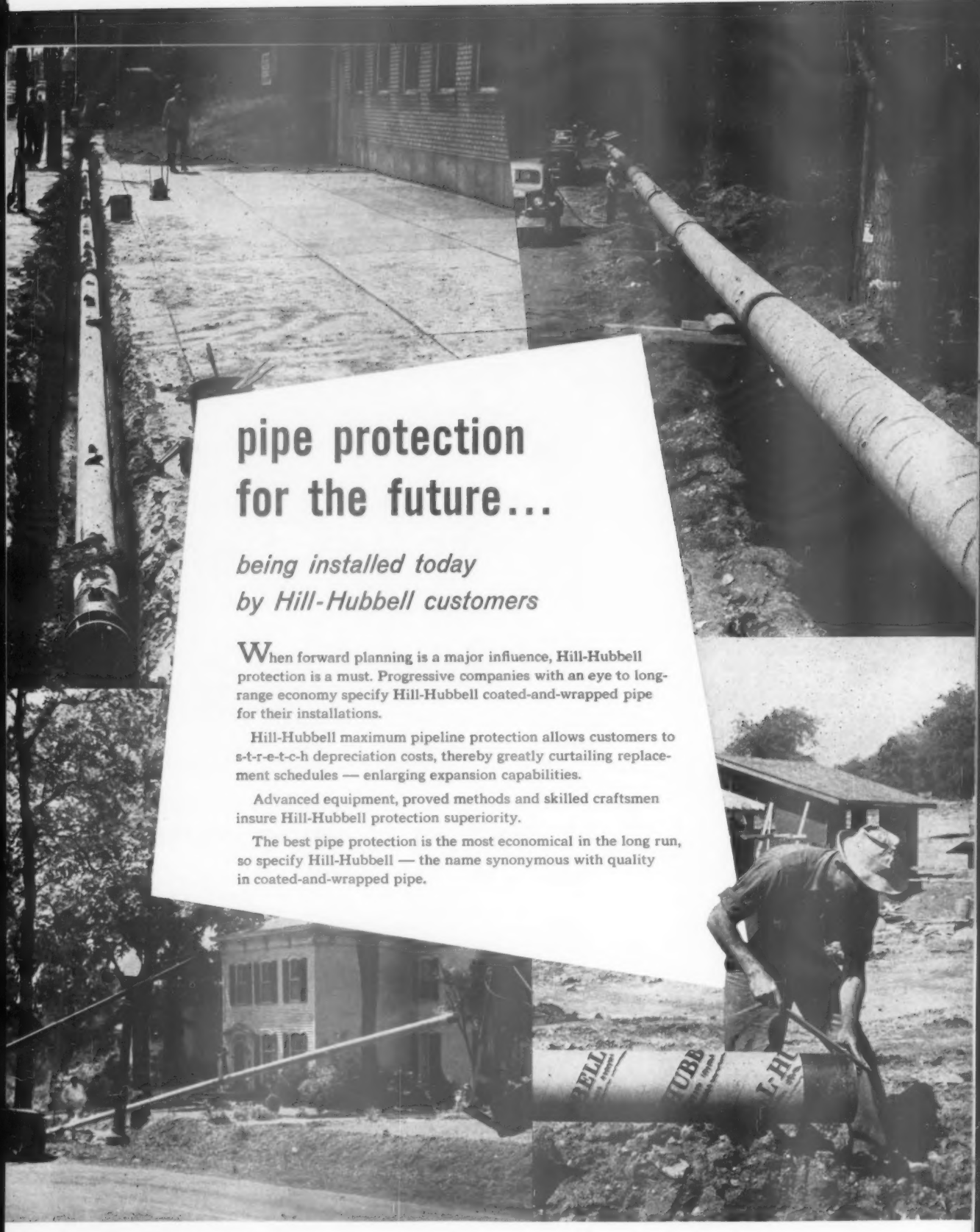
Waste gases from the 25,000-bbl. cat cracker, built in 1943, are well within restrictions set by the Los Angeles Air Pollution Control District. However, the CO boiler was decided upon because it would further cut down on air pollution.

. . . A poor payout is foreseen because of the waste gases' low sensible-heat content. As the cat cracker already was equipped with waste-heat-recovery devices, temperature of the regenerator flue gas is about 500° F.

At boilers installed in conjunction with new cat cracking units, temperature of the waste gases is in the range of 1,000° F. and higher. This sensible heat and that generated from burning the CO to CO_2 supplies some 60 to 75% of the total heat generated in the boiler. For this reason their extra cost, as compared with conventional steam-generating equipment, usually can be returned in 4 or 5 years.

At the new Shell unit, officially placed in operation last week, sensible heat contributes nothing to steam generation since the gases are discharged at about 500° F. Combustion of the CO contributes 20 to 25% of the heat; the remainder must be furnished by refinery and natural gas fuels. For this reason some 10 years or longer will be needed to justify the extra cost.

The Shell unit is the second to be installed in Los Angeles refineries. Standard Oil Co. of California soon will complete a CO boiler at its Los Angeles plant and Union Oil Co. is planning one for its refinery there. Economics of these installations probably will be similar to Shell's since they also will be added as an air-pollution-control effort.



pipe protection for the future...

being installed today by Hill-Hubbell customers

When forward planning is a major influence, Hill-Hubbell protection is a must. Progressive companies with an eye to long-range economy specify Hill-Hubbell coated-and-wrapped pipe for their installations.

Hill-Hubbell maximum pipeline protection allows customers to s-t-r-e-t-c-h depreciation costs, thereby greatly curtailing replacement schedules — enlarging expansion capabilities.

Advanced equipment, proved methods and skilled craftsmen insure Hill-Hubbell protection superiority.

The best pipe protection is the most economical in the long run, so specify Hill-Hubbell — the name synonymous with quality in coated-and-wrapped pipe.

Specify Hill-Hubbell wrapped pipe on your next job . . .

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FACTORY APPLICATORS OF COATINGS AND WRAPPINGS

▶ ▶ ▶ New Equipment Section

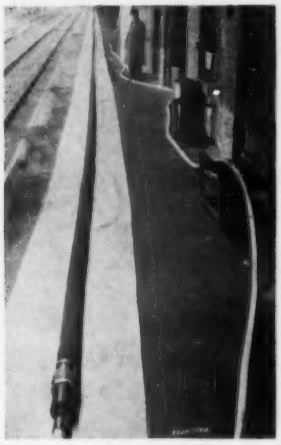
This week's SHOWCASE features . . .

Truck with glass-fiber tilt cab

. . . is being produced for use in oilfield servicing. The model illustrated has a wheelbase of 187½ in.

The tandem rear axle has a 5.62 ratio and a capacity of 38,000 lb.

The front axle has a capacity of 11,000 lb. The truck has power steering and a 50-in. front-bumper to back-of-cab dimension. **Contact Manufacturer: White Motor Co., 842 East Seventy-ninth Avenue, Cleveland 1, for details on Model 5064D truck.**



Four-inch 500-ft. hose produced

. . . without splices. The result of a new continuous production process, the hose can be produced in lengths limited only by the size of the transportation facilities to handle it. Biggest savings offered is through elimination of couplings and troublesome splices. The hose can be handled in reels, permitting savings in weight and handling costs.

The hose looks promising for offshore unloading of tankers, offshore drilling and production, and as a temporary pipeline. It can be manufactured so it will sink or float and to handle all known chemicals and fuels. The production process can be adjusted to produce hose in sizes from 2 to 8 in. i.d. **Contact Manufacturer: Goodyear Tire & Rubber Co., Akron, for details on continuous hose.**

Gas chromatograph to take samples

. . . of ultrapure materials in volumes 100 times larger than possible with older types with no sacrifice in resolution has been developed. The Megachrom instrument uses the separatory power of chromatography to fractionate and collect sizable quantities of ultrapure materials which previously have been barely visible or seen only as traces on a recorder chart. Applications for the instrument include studies on materials which are volatile at temperatures up to 752° F. with samples as large as 20 ml.

Hydrocarbon studies such as the separation and investigation of the hydrocarbon components of gasoline can be made. Studies on byproducts of organic synthesis in the petroleum industry can also be made with the instrument.

The instrument is self-contained. Besides the large chromatographic column capacity, it includes an automatic sample-collection system, recorder readout, recycling pump, and cleanout traps for extending the life of the carrier gas. Its over-all dimensions are 50½ in. wide, 62½ in. high, and 39 in. deep, including the workbench counter that extends the entire length of the control panel. **Contact Manufacturer: Beckman Instruments, Inc., 2500 Fullerton Road, Fullerton, Calif., for details on Megachrom.**

Send this Showcase Coupon

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

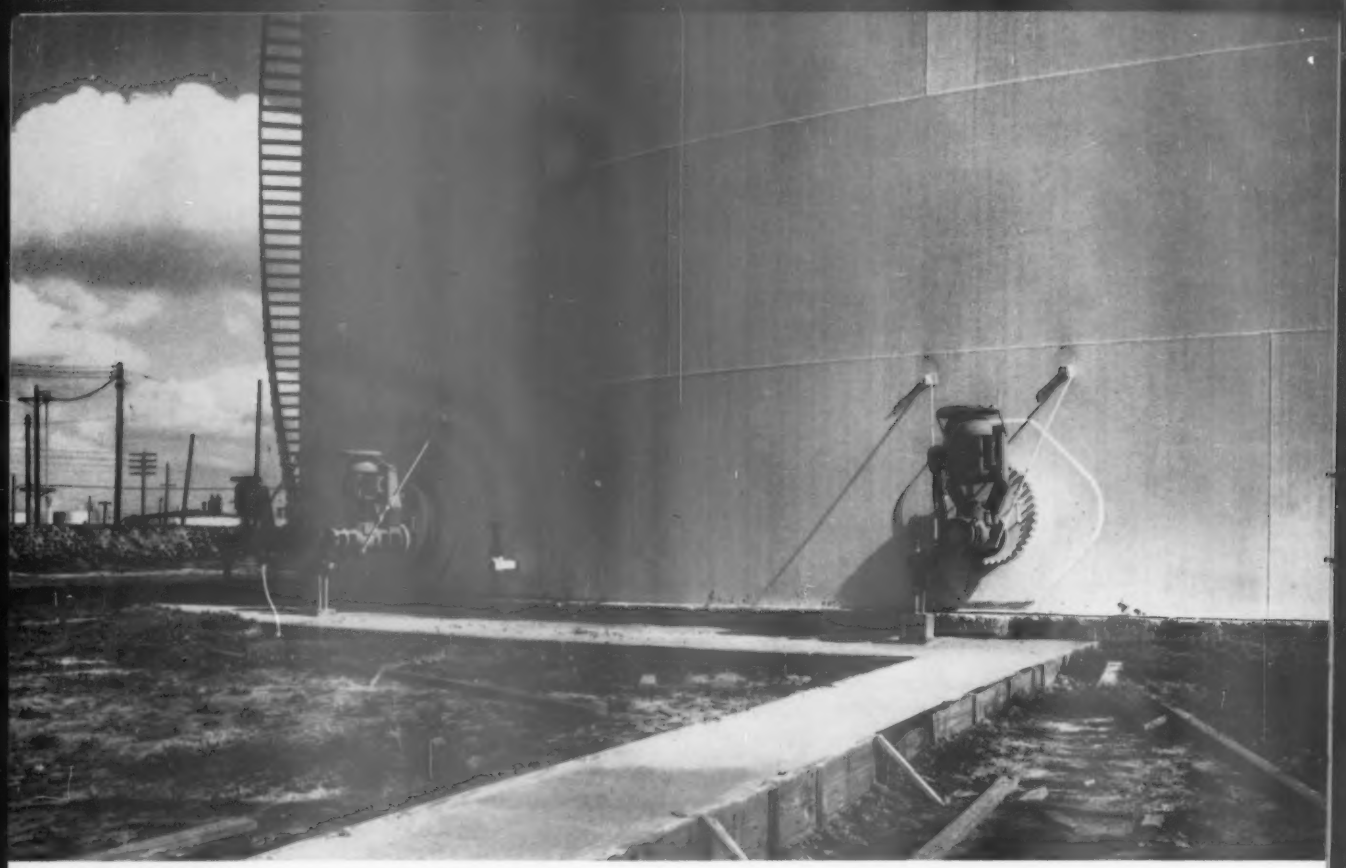
Described in OIL AND GAS JOURNAL - Issue of July 13, 1959

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

CITY.....STATE.....



How they keep crude from **stacking up like pancakes**

Surging into this tank come crudes from wells scattered over 23 counties.

Out of the tank comes *one* crude, at the right gravity to feed to refineries more than 450 miles away.

For the men who run the tank farm, it's no chore at all to blend 122,000 barrels of crudes ranging from less than 20° to above 85° in gravity. They do it by flipping three switches.

The LIGHTNIN Mixers you see here do the rest. While the tank is filling, and for two or three hours before it goes on suction, the mixers create a powerful, steady turnover that breaks up stratification from the bottom up. The outgoing tender of crude stays within a degree or two of constant gravity.

Control BS&W, too. That's not all. These mixers help keep sludge from settling on the tank bottom and stealing valuable storage space. They keep the tank working at its full capacity.

Multiply these savings by the number of tanks at this farm equipped with LIGHTNIN Mixers—and you can see why more than 50 pipeline companies and 35 leading oil companies use this easy way to keep operating costs in line.

How about you? If you'd like to see how LIGHTNIN Mixers on your big tanks can save you as much as $1000 per tank per year, call in your LIGHTNIN representative. He's listed in Composite Catalog. Or write us today.

YOU CAN ADD as much as 12% extra storage capacity to your tank farm—by using LIGHTNIN Mixers to keep tanks free of space-eating sludge. Mixing results are unconditionally guaranteed.

Lightnin® Mixers

MIXCO fluid mixing specialists

Get these helpful bulletins on BS&W control and LIGHTNIN Mixers. Check, tear out and mail to us today with your name and company address. Free—no obligation.

- ☐ BS&W Control with LIGHTNIN Mixers (B-503)
- ☐ Side-entering mixers, 1 to 25 hp (B-104)
- ☐ Data sheet for figuring mixer requirements (B-107)
- ☐ Condensed catalog describing LIGHTNIN Mixers—all types (B-109)
- ☐ LIGHTNIN rotary mechanical seals to eliminate stuffing-box maintenance (B-111)

MIXING EQUIPMENT Co., Inc., 174-g Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.

SHOWCASE . . .

New Equipment

Bubble caps for sulfuric acid

. . . service are now being produced from a thermosetting plastic material which, the maker reports, meets the corrosive-resistance requirements of refining and chemical processing.

One advantage cited for the molded parts is that they are lower in cost than other types. Presently, the caps and risers are in production in sizes as large as 8 in. o.d. **Contact Manufacturer: Wyatt's Plastics, Inc., P. O. Box 3052, Houston, for details on plastic bubble caps.**

•

Jet perforator to increase well flow

. . . by providing deep penetration and exceptionally large and clean holes has been announced. The Atlas-Jet shaped charge is for use with conventional 4 and 5-in. jet guns. The weight of the explosive in the charge has not been increased over that used previously in conventional type of shaped charges. **Contact Manufacturer: Perforating Guns Atlas Corp., Houston, for details on new Atlas-Jet charge.**

•

Crawler tractor lifts 46,000 lb.

. . . of pipe at a 4-ft. overhang. The SBI-150-BH sideboom for the TD-15 tractor has a hydraulic counterweight.

Providing 105 drawbar horsepower, the tractor has a track-on-ground length of 98⅜ in. The engine and transmission guards are completely enclosed and levers are stacked for operating ease and safety. A gear-driven drum on each shaft provides cable alignment. **Contact Manufacturer: International Harvester Co., 180 Michigan Avenue, Chicago 1, for details on TD-15 tractor.**

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Specialists in

REFINERY & CHEMICAL PLANT

- START UPS
- PERFORMANCE TEST RUNS
- CONTINUOUS PLANT OPERATION

Immediate service—for any time desired. Brochure and staff resumes on request.

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Dependable

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BATON ROUGE LA.

MAP FILE

#MT4

Easiest way to file and find confidential maps, tracings, blueprints. Quality metal cabinet file with locking doors. 112 tilting tubes handle 60" prints. Tubes indexed for quick location. Ideal for field and home offices. Shipped from stock.

Patent No. 1610368. Other Patents Pending.

SCOTT-RICE CO., 610 S. Main, Tulsa 3, Okla.

SAFER for FLAMMABLES

NEW LUFKIN "JET" TAPE

Here's the *safer* tape the oil industry needs for jet fuels. Stainless steel line is Chrome Clad®. Handle is wood. All other parts are non-sparking metals. See your Lufkin dealer for this new oil gaging tape.

THE LUFKIN RULE COMPANY
TAPES • RULES • PRECISION TOOLS
SAGINAW, MICH. • MIDDLETOWN, N.Y. • BARRIE, ONT.

80%

Eighty percent of all mined underground storage for LPG has been constructed by Fenix & Scisson, Inc.

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Grip-Tite
PIPE LINE
ANCHOR ASSEMBLY
"DEAD MEN THAT HOLD!"

Grip-Tite Pipe Line Anchor Assembly is designed for protection to pipe coating and for permanent hold-downs of all kinds of pipe line construction. Costs only a fraction of cast iron or concrete weights. No heavy equipment needed for installation. They save time, labor and afford protection from heavy weight damage during installation. *Thousands in trouble-free use today!*

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EXPANDING Grip-Tite ANCHORS

Grip-Tite MANUFACTURING CO.
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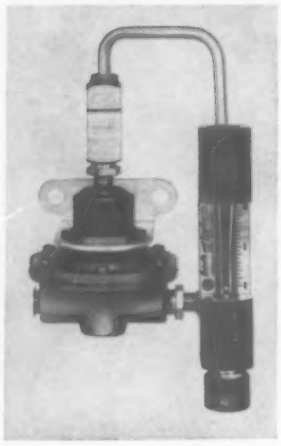
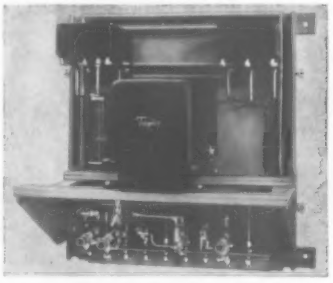


Purge type of rotameter

. . . just announced is designed to measure and control fluids flowing at small rates. Stainless steel and other corrosion-resistant materials are used for the fluid-contacting surfaces. The rotameter is small enough to hold in the hand. Nine capacity ranges can be obtained by selecting from a series of interchangeable tubes and floats for use in the same basic body. Capacities range from 0.6 gal. an hour of water or 0.5 cu. ft. an hour of air (metered at 10 psig.) up to 12 gal. an hour of water and 70 cu. ft. an hour of air.

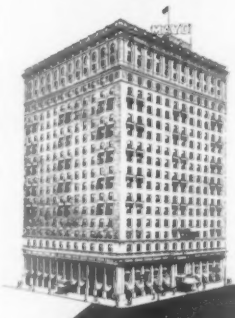
The rotameters can be used to prevent process fluid from entering connecting piping and the sensing elements of instruments. They can be used too for indicating and controlling the flow of supply air or inert gas to bubbler type of liquid-level and specific-gravity installations. **Contact Manufacturer: Schutte & Koerting Co., Cornwells Heights, Bucks County, Pa. for details on purge type of rotameters.**



Fractionating-column control

. . . system recently made available offers a way to increase product uniformity while reducing steam consumption and the danger of column flooding. The instrument is designed to compensate for climatic effects on

THE HOTEL

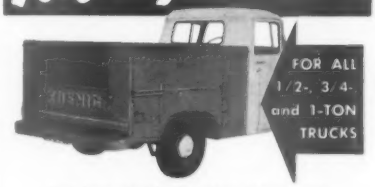


in the Oil Capital of the World

100% Airconditioned
600 Bright *Reasonably* Priced Rooms

THE MAYO
TULSA'S *Finest* HOTEL
Sample Rooms - Finest Food
Adjacent Garage

Koenig ALL-STEEL SERVICE BODIES



FOR ALL 1/2-, 3/4- and 1-TON TRUCKS

Each body electrically welded into one unit with bed reinforced. Sturdy and economical . . . weatherproof compartments with recessed paddle-handle door locks.

Write for literature on service bodies, line-construction bodies, side boxes, and King Winches.

KING WINCHES

A-11 King Winch on A-120 (4 x 4) International truck. There's a front-mount King Winch designed to fit your specific needs . . . for ½-ton through 2½-ton trucks . . . pulling capacities of 8,000 to 19,000 lbs.

P. T. O.-driven King Winch on Willys Jeep FOR ALL WILLYS JEEPS, 4 WD TRUCKS AND 4 WD STATION WAGONS. Power-take-off-driven King Winch models 130J and 131J for CJ-3B and older-model Jeeps, can be transferred to CJ-5 and CJ-6 Jeeps . . . nothing extra needed.

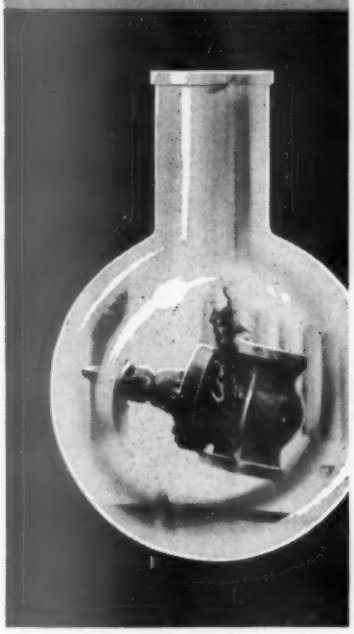
King Winches for International trucks available through International dealers.

Koenig cabs and King Winches for Willys vehicles available through all Willys dealers.

Koenig IRON WORKS, INC.
P. O. BOX 7726, HOUSTON 7, TEXAS

Oakite

ECP...



Best way to save with salvage

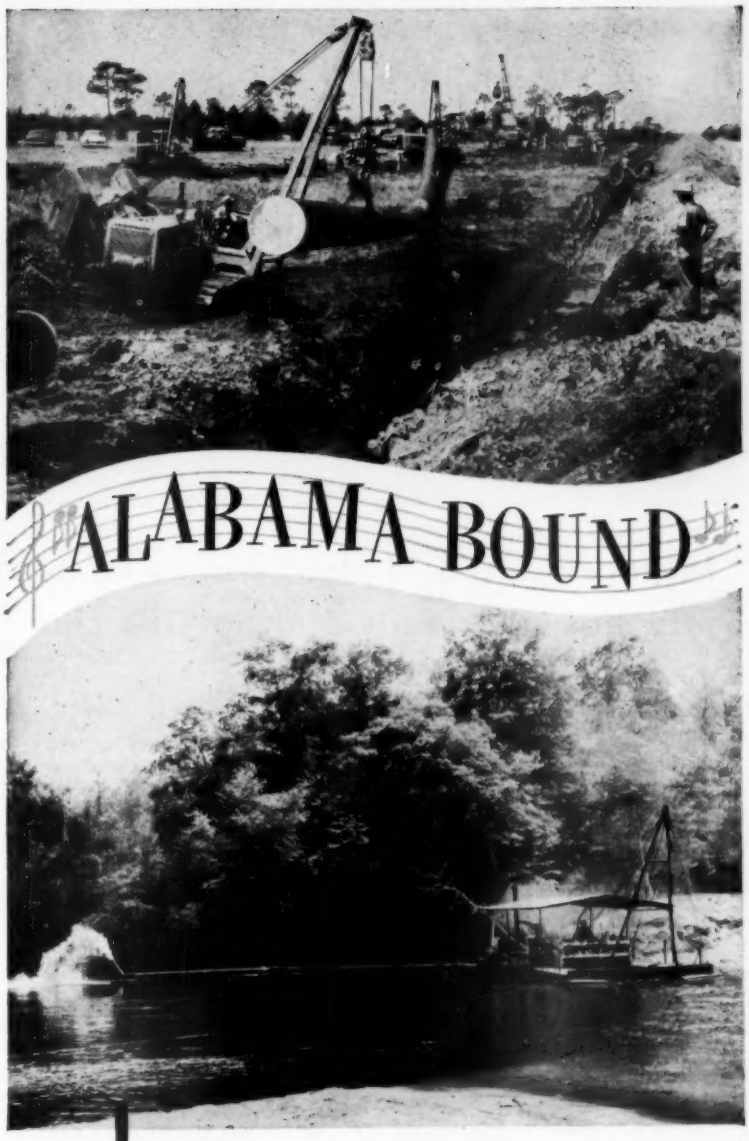
RESULTS show that the best way to salvage equipment is the Oakite ECP way . . . which reclaims parts in volume via chemical cleaning. At one refinery, salvage became a major cost control factor with installation of permanent Oakite tanks. They cut cleaning time *from 22 hours to 1½ hours* a batch, slashed material cost *from $1.90 a gallon to less than 23 cents.*

An Oakite ENGINEERED CLEANING PROGRAM is developed specifically for your refinery, gives detailed recommendations for everything from coolers to crackers. The Oakite engineer sticks with the job till it's done to satisfaction. Along with his experience go products and methods developed by one of the finest chemical cleaning research facilities in existence.

Send for more data. Oakite Products, Inc., 39 Rector St., New York 6, N. Y.

OAKITE ECP your economy key

In our 50th year



ALABAMA BOUND

This 30-inch gas transmission line is Alabama bound through the lowlands of Mississippi . . . another pipe line job completed on time because of Houston Contracting's experienced planning. Whether crossing a quiet river or battling through the treacherous marshlands, engineered construction calls for the skill and experience of Houston Contracting.

HOUSTON CONTRACTING COMPANY

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OIL • GAS • PRODUCTS • WATER PIPELINES

Leland "Packaged Unit" makes tough jobs easy on Texas-Florida Gas Line

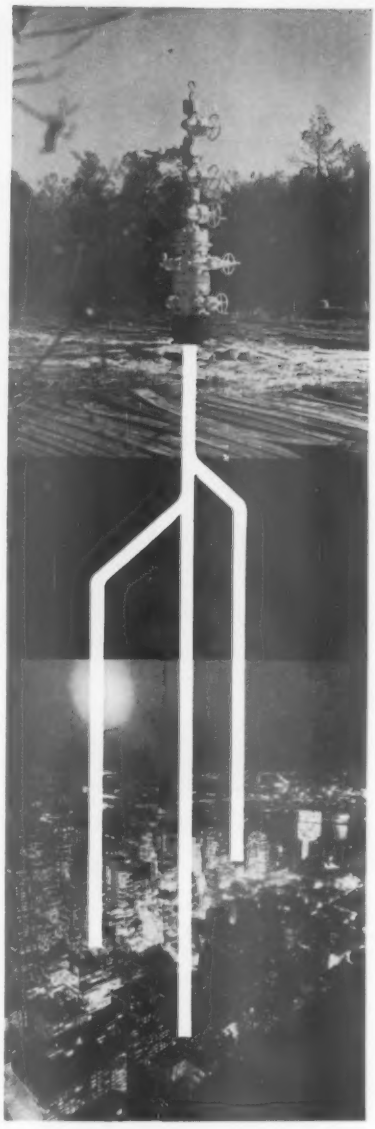
On the 2600-mile gas line now under construction between McAllen, Texas and Miami, Florida, Leland "Packaged Units" are doing a workhorse job. On-the-road or off-the-road, towing or winching, the proven "Packaged Unit" gives operators dependable performance plus five important extras . . .

- **Headache Rack** — tough, hydraulic tubing for complete protection
- **Gin Pole Pocket** — one piece steel casting for single or double setting
- **Body Deck Plate** — flush mounted, 2" center-matched hardwood and tempered steel
- **Winch Mounts** — for safety & strength with or without winch
- **Rolling Tail Pipe** — seamless hydraulic tubing on shielded ball bearings

The workhorse line of Leland truck bodies is your best bet for heavy duty trucking. Investigate the advantages of Leland's "Packaged Unit" . . . Fifth Wheel Body . . . Pole Trailers . . . and Self-Loading Floats.

Call Leland for fast parts delivery and service on truck and construction equipment. Parts and service are available on such leading lines as Thew-Lorain . . . Gardner-Denver . . . C-M-C . . . Blaw Knox . . . Cedarapids . . . Cleveland Trenchers . . . Tulsa Winches.

Leland
EQUIPMENT COMPANY
Oklahoma City • TULSA • Longview, Texas



Carrying Texas and Louisiana natural gas to the markets where the most people are

TRANSCONTINENTAL GAS PIPE LINE CORPORATION

the reflux system and cyclic fluctuations frequently occurring with conventional fractionator instrumentation.

Developed and licensed by Phillips Petroleum Co., the reflux computer-control system permits a single analog computer to provide a practical means of measuring and controlling the internal reflux flow from the top plate of a fractionating column. The use of high-speed computer operation allows ample time for correction of external reflux flow rate before the effects of change in internal reflux flow rate become significant. **Contact Manufacturer: Taylor Instrument Companies, 95 Ames Street, Rochester 1, N. Y., for details on internal reflux computer control system.**

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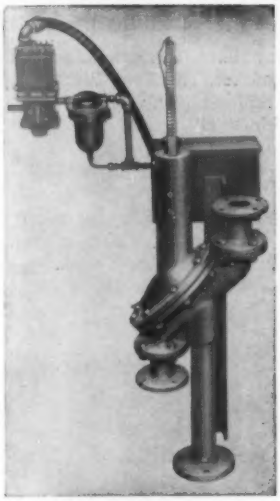


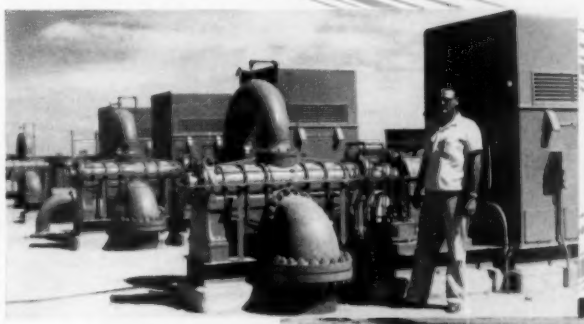
Controlled volume pump for slurries

. . . is now being produced that utilizes a diaphragm-slurry-pump design principle. The ODS pump is capable of handling abrasive slurries containing up to 60% solids and of delivering them at pressures up to 90 psi. Since the diaphragm action is gentle, it minimizes particle degradation.

Essentially, the pump consists of two hemispheres clamped together with a slack diaphragm between them. The lower hemisphere is equipped with inlet and outlet check valves. The upper one is connected to the air supply by a three-way solenoid valve which alternately pressurizes and exhausts the chamber. A timer electrically operates the valve.

Flow volume can be varied from 0 to 180 gal. an hour. Stroke length can be regulated by an electrical probe mechanism. **Contact Manufacturer: Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, for details on ODS pump.**

Warren's High Pressure Screw Pump is proving its true economy with pumping efficiencies of 75% to 85% – on either high or relatively low viscosities



Warren #8CB Screw Pumps handling crude oil at a primary pumping station.

In crude line, product line and refinery jobs Warren High Pressure Screw Pumps —

- develop continuous flow
- can be direct driven . . . speed reduction gears are not necessary
- maintain constant capacity and pressure, even on oil containing foreign matter
- are suitable for unattended stations.

WRITE FOR SELECTION NOMOGRAPH #252

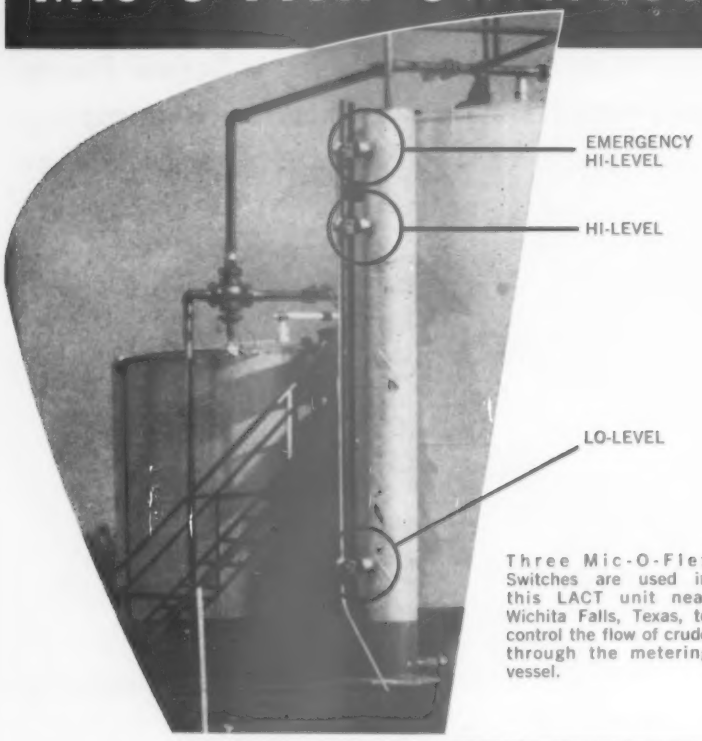
CENTRIFUGAL SCREW RECIPROCATING GEAR

WARREN PUMPS, INC.

WARREN, MASSACHUSETTS

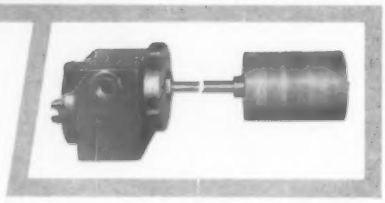
0-1

Mic-O-Flex Switches



Three Mic-O-Flex Switches are used in this LACT unit near Wichita Falls, Texas, to control the flow of crude through the metering vessel.

INSTALLED IN LIQUID LEVEL CONTROL BOOT



Mic-O-Flex Switches are electric, positive action float-type liquid level controllers, using Flextubes® to actuate a micro-switch. Mic-O-Flex Switches may be used as high or low level limit switches to sound alarms, flash signal lights, start or stop pumps or operate control valves. They are unaffected by extreme pressures or temperatures, and are ideal for use on low dielectric liquid hydrocarbons.

SPECIFICATIONS:

SWITCH: S.P.D.T. Micro-switch, 15 amp., 125, 250 or 460 V.A.C.
HOUSING: Explosion-proof
PRESS. RATING: Up to 1000 psi
MOUNTING CONNECTOR: 4" flange or grooved coupling adaptor
ADJUSTMENTS: Fine and coarse sensitivity, set-point 3½" span
FLOAT: 3½" diameter Synthane discs

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INSTRUMENTS, INC.

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PIONEERS IN LEVEL MEASUREMENT AND CONTROL INSTRUMENTATION

SHOWCASE . . .

New Equipment

Bit with replaceable blades

. . . for hard formations is now on the market. The Type WC carbide-insert replaceable-blade bit is precision machined of forged alloy steel and heat-treated.

It is available in 3⅞, 4½, 4¾, and 5⅞-in. sizes for shale, medium and hard formations, and in all drill-pipe connections. **Contact Manufacturer: J. T. Williams Co., Tonkawa, Okla., for details on Type WC bit.**

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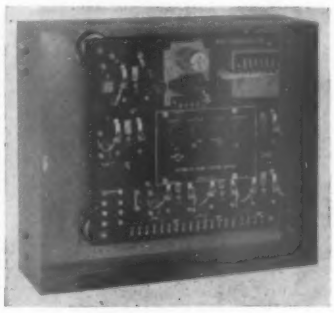
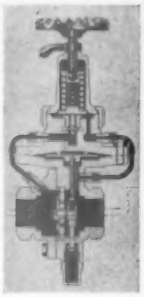


Automatic engine-starting control

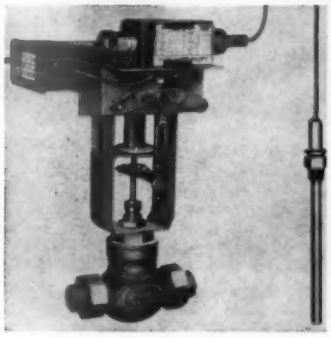
. . . intended for fully automatic starting and stopping of engine-driven generating sets is now available. According to the maker, the new starting control: (1) positively prevents re-cranking at full engine speed; (2) is designed to respond at 50% of normal battery voltage; (3) operates over a broad ambient-temperature range; (4) offers repeated or continuous cranking cycles provided by the same panel; (5) contains industrial control-type components throughout; and (6) operates from a single-pole contact on the automatic transfer switch or control station. **Contact Manufacturer: Automatic Switch Co., Florham Park, N. J., for Publication 653.**

Piloted pressure regulator



. . . obtainable in ½ to 2-in. sizes has been redesigned in an effort to improve performance by providing less maintenance, tight shutoff, and more accurate regulation. The regulator incorporates sliding gate and plate seats and new external sensing tubes, Teflon pilot seat, and ball-bearing adjustment. It's suitable for pressures to 250 psi. and temperatures to 450° F. and is available in bronze, cast iron, and ductile iron with screwed ends. **Contact Manufacturer: OPW-Jordan, 6013 Wiehe Road, Cincinnati 13, for Bulletins SRB-16-59 and J-1160.**

●



Process control instrument

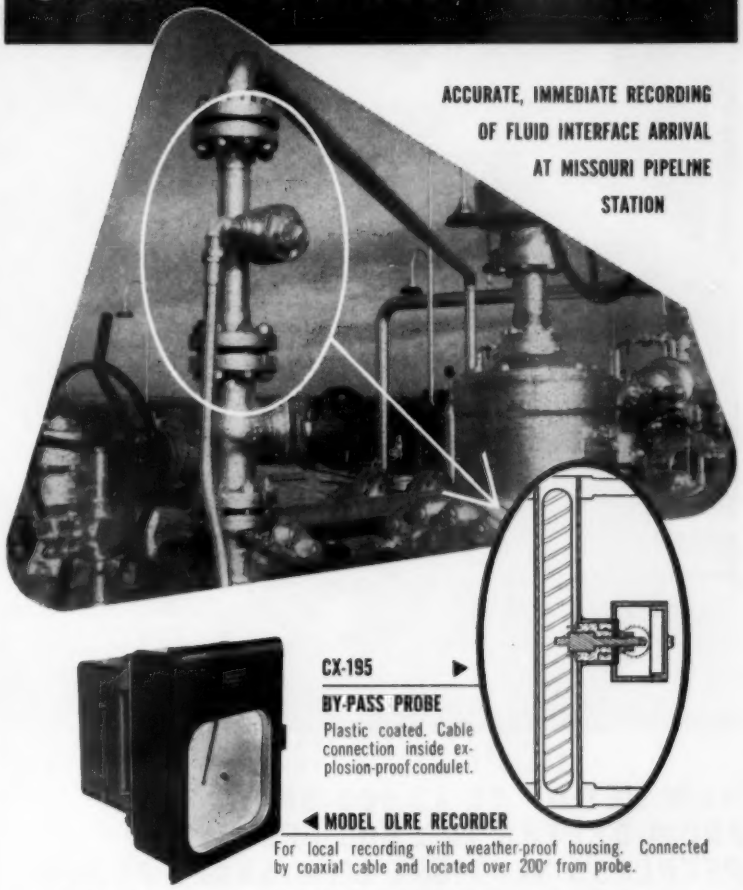
. . . that is an electrically operated modulating type has been developed to control process pressures or temperatures. It enables the small plant to maintain precise control normally possible only where a compressed-air supply was available.

The Fultro-lectric instrument is a combination controller, positioner, and valve. When the measured variable changes, it causes a switch to actuate a shaded-pole three-wire reversible motor. The motor then drives the valve in the desired direction. When the valve reaches the position called for by a small temperature-sensing bulb, a feedback switch quickly stops the motor.

Noteworthy features of the instrument include a small temperature-sensing bulb with high response rate, adjustable proportional band, positive valve positioning, easy installation, 1-in. stem travel, and manual valve positioning. **Contact Manufacturer: Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Box 400, Knoxville 1, Tenn., for details on Fultro-lectric.**

BATCH INTERFACE DETECTION BY THE . . .

CAPACITANCE PRODUCT ANALYZER


ACCURATE, IMMEDIATE RECORDING
OF FLUID INTERFACE ARRIVAL
AT MISSOURI PIPELINE
STATION
CX-195 ▶
BY-PASS PROBE
Plastic coated. Cable connection inside explosion-proof condulet.
◀ MODEL DLRE RECORDER
For local recording with weather-proof housing. Connected by coaxial cable and located over 200' from probe.

CPA measures and records interface, water content or component changes in the fluid stream by measuring dielectric differences of fluid passing through a probe. Recording is on 12" round chart.

SPECIFICATIONS

Range of Measurement: 4.3 MMFD minimum and 1100 MMFD maximum (equal to 1% min. and 35% max. for water in oil)
Accuracy: Within 0.5 of 1% of actual capacitance indicated (equal to ±0.15 of 1% water in oil)
Sensitivity: Standard — 0.043 MMFD equivalent to 0.01 of 1% water contamination in oil
Power: 115 volt, 60 cy. A.C.
Recorder Motor: Electric or spring wound
Recording: Local — at or near point of measurement; Telemetering — over any pair of telegraph grade wires; Pneumatic — provides air signal at distant point
Housing: Explosion-proof or weather-proof
Optional Accessories: High-low alarm switches; 7-day or 30-day recording charts; Temperature compensation
Probes: 2", 3" and 4" flanged, grooved or threaded

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INSTRUMENTS, INC.

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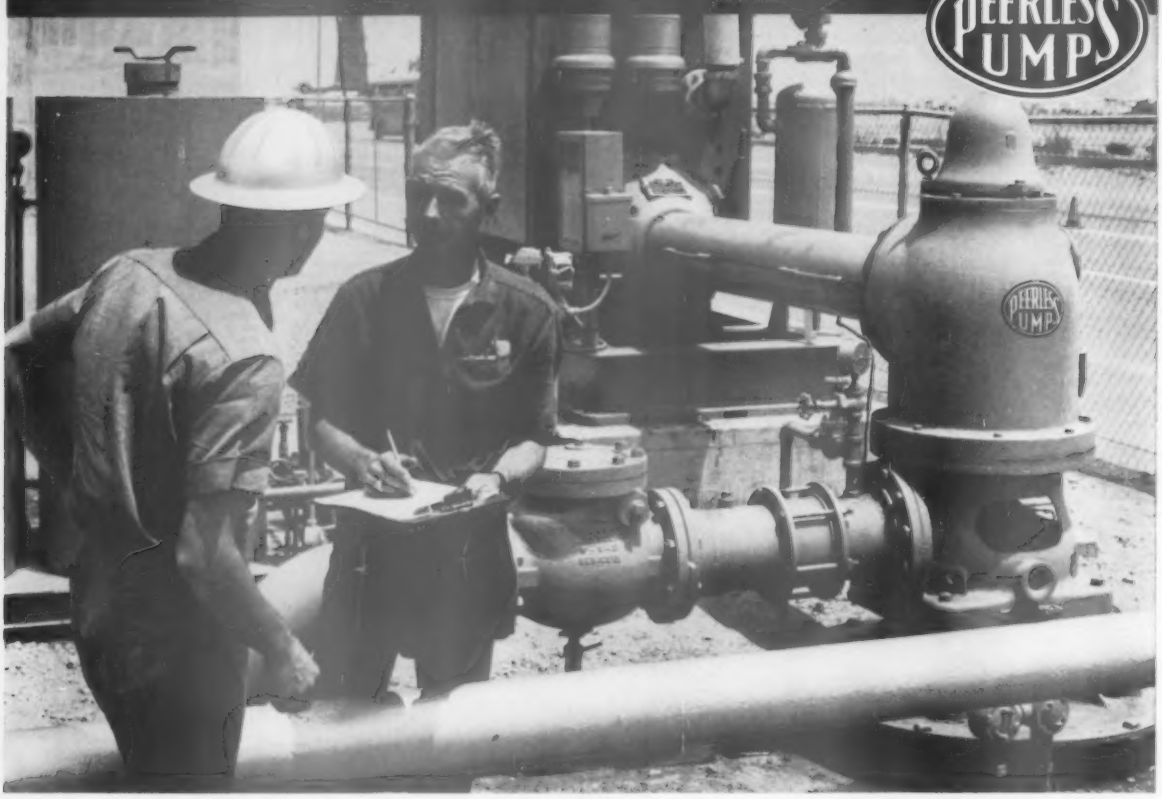
PIONEERS IN LEVEL MEASUREMENT AND CONTROL INSTRUMENTATION

Progress Report on Source Water Pumps for Secondary Recovery from

PEERLESS PUMPS



For Source Water. The Peerless Vertical Line shaft pump is adaptable to all type drives. In addition to the right angle gear drive pictured above, the pump may be ordered with a vertical hollow-shaft electric motor.

NOW GET UP TO 15,000 BPD FROM DEPTHS TO 1,500 FEET WITH PEERLESS VERTICAL LINE SHAFT PUMPS

Whether your source water is 150 feet or 1,500 feet deep, the Peerless vertical line shaft pump is the ideal pump for a steady dependable flood water supply. That's because it is big enough to do the job—up to 15,000 BPD from well depths to 1,500 feet; it is flexible enough to fit any water flood project; and it has been proved on the job over periods of up to five years of continuous flood water supply service.

Moreover, Peerless vertical line shaft pumps are specially built for the rigorous duty of handling corrosive fluids encountered in flooding operations. For example, the water lubricated type most frequently used for this service has special shaft bearings that are most resistant to the damages of abrasives and corrosives in the fluids being pumped.

And Peerless offers you a number of different models permitting the vertical line shaft pump to be tailored to your area and water flood conditions. An informative bulletin on these pumps is available to you upon request.

Write today and request your copy of Bulletin B-102.

For Injection Service. Peerless Hydro-Line pumps have capacities up to 175,000 BPD and pressures up to 1000 psi. Pumps are well suited to handle corrosive liquids, and by adding or removing stages pressure can be carried without loss of efficiency.

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301 West Avenue 26, Los Angeles 31, California

Send me Bulletin B-102 ☐ Have a field engineer contact me ☐

Company_____

Name_____ TITLE

Address_____

City_____ State_____

SHOWCASE . . .

New Literature

Air-cooled diesel engines

. . . are detailed in the two new four-page bulletins, yours upon request. The publications present technical data, principal dimensions, specifications, optional extras, line drawings, and photographs of three types of engines—HA, LD, and SL. **Contact Manufacturer: Lister Blackstone, Inc., 42-32 Twenty-first Street, Long Island City 1, N. Y., for Air-Cooled Diesel Engine bulletins.**

Bar-chart recorder

. . . which is capable of reporting on 22 machines at once is outlined in an obtainable 18-page publication. The instrument automatically and continuously records how long machines were idle, and when the down time occured. Accuracy is within 2 minutes, the literature relates.

It also contains general information, component parts, capacities, a full-page example of a graph taken from the recorder, code types, wiring information, a price schedule, and a sample budget-estimating form for the recorder system. **Contact Manufacturer: Gorrell & Gorrell, 338 Old Hook Road, Westwood, N. J., for Bar-Chart Recorder literature.**

Y-insert gasket

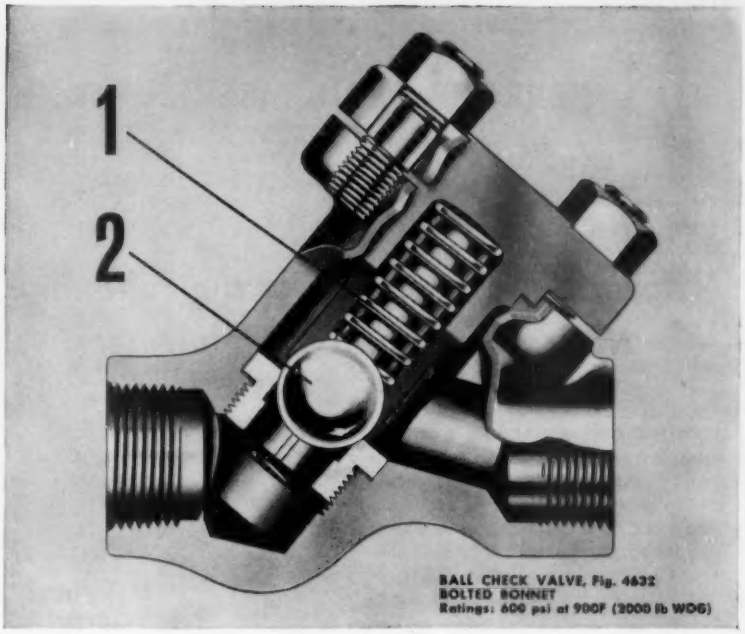
. . . for cement-lined pipe eliminates cavity between pipe ends and seals bare end of pipe from line fluid, reports new two-page Bulletin Y-59, now available. Another bulletin, on the Style 88 rigid coupling, is also obtainable from the manufacturer.

The coupling's uses include tank batteries, LACT, field headers, water-flood manifolds, and other oilfield piping. Both publications offer applications, specifications, and features. **Contact Manufacturer: Victaulic Co. of America, P. O. Box 509, Elizabeth, N. J., for Bulletin Y-59 and Style 88 Rigid Coupling bulletin.**

Bulletin describes three-way valves

. . . for simplifying feedwater heater bypass arrangement. Four page Bulletin 8F includes sectional drawings and information on design features, materials of construction, operation, and application.

It also contains piping diagrams which give a comparison of the



BALL CHECK VALVE, Fig. 4632
BOLTED BONNET
Ratings: 600 psi at 900F (2000 lb WOG)

You get longer valve life with . . .

Edward Check Valves for petroleum services

For the many petroleum services from oilfield to refinery where protection against flow reversal is required, Edward furnishes a complete line of forged steel check valves for horizontal or vertical installation.

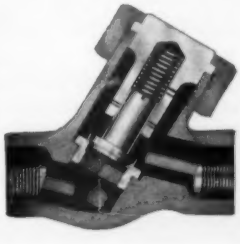
EDWARD BALL CHECK VALVES are specially designed to provide rugged, shock-free service where liquid or heavy viscous fluids are piped. The stainless steel spring (1 above) is sized and rated to give positive seating with heaviest of fluids. And the ball disk (2), made of EValloy 16% chromium stainless steel for tight seating, can be easily replaced when needed.

EDWARD PISTON CHECK VALVES also give freedom from shock or vibration, plus streamlined body design for full flow area and low pressure drop. Exclusive disk guide and spring loading allow for quick, positive seating.

LONG-LIFE FEATURES—Here are just a few design characteristics that make Edward check valves your best buy for petroleum services:

- your choice of screwed, socket welding or flanged ends
- rugged bodies of specially heat treated forged steel
- strong spring of stainless steel for sure closing action
- corrosion-proof stainless steel seats, and stainless steel piston disks or ball disks
- union, screwed, or bolted bonnet available

Edward builds a complete line of cast and forged steel valves for pressures to 10,000 lbs, with flanged, screwed, socket or butt welding ends. For additional information, see your favorite distributor, or write Edward Valves, Inc., 1212 West 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Company.


PISTON CHECK VALVE, Fig. 3578
UNION BONNET
Ratings: 1500 psi at 850F (3600 lb WOG)

EDWARD STEEL VALVES
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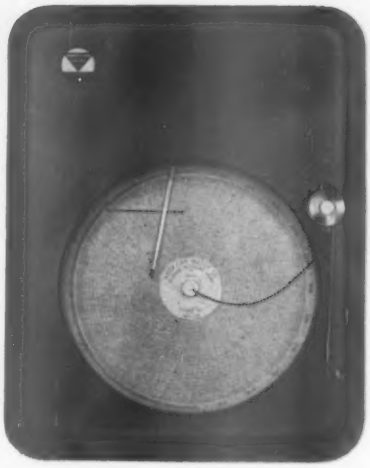

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piping and fabrication requirements of a three-way bypass valve and conventional installations. **Contact Manufacturer: Schutte & Koerting Co., Dept. V-E, Cornwells Heights, Bucks County, Pa., for Bulletin 8F.**

Diacel cement systems

. . . for control of density, water loss, and thickening time, are detailed in new 38-page revised Booklet D-22. The pocket-size technical-data booklet contains tables and other data on the application of low-density cements and a retarder and low water-loss cement additive. **Contact: Drilling Specialties Co., Bartlesville, Okla., for Booklet D-22.**

Sight-flow indicators

. . . are discussed in a new two-page publication which provides information on the size range, materials, pressure-temperature ratings, and dimensional specifications of reflex and transparent sight-flow indicators, designed for easy installation on new or existing pipelines.

Bulletin 350 also gives specifications on a new high-pressure drip-sight feeder for low or high-temperature applications. **Contact Manufacturer: Jerguson Gage & Valve Co., 80 Adams Street, Burlington, Mass., for Bulletin 350.**

Water-cooled compressors

. . . of the single-stage and horizontal type are detailed in two-color Bulletin 350. Photographs, line drawings, and artists' cross-sectional views illustrate construction and show details of component parts. The eight-page publication also lists sizes, capacities, and ratings in tubular form. **Contact Manufacturer: Pennsylvania Pump & Compressor Co., Easton, Pa., for Bulletin 350.**

Method extends dragline range

. . . to handle difficult jobs, as shown in a new four-page field report, free upon request. Field Report 231 shows how the reach of any dragline-crane can be greatly increased by using the hoisting line as a track cable for a DragScaper and carrier assembly.

So equipped, the machine's range is limited only by the spooling capacity of the drums. The publication reports that large machines usually double their rated bucket size with the new method; smaller units can use about a half-size larger.

This is possible, according to the report, because the crescent is much lighter, size for size. In addition, the

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EASY TO OPERATE
H&M PIPE CUTTING & BEVELING MACHINES

H&M Pipe Cutting and Beveling Machines provide quick, efficient, automatic preparation of pipe for welding . . with savings up to 50% over the cost of manual cutting. Lightweight H&M Machines are easily operated by one man and even inexperienced operators give excellent results after only a few minutes instructions on an H&M.

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REPRESENTATIVES AROUND THE WORLD

bottomless crescent hauls at ground level and deposits its load automatically when lifted by the crane. **Contact Manufacturer: Sauerman Bros., Inc., Dept. 0-3, 620 South Twenty-eighth Avenue, Bellwood, Ill., for Field Report 231.**

Refractory-cements publication

. . . contains 20 pages of information on refractory-cement specialization, printed in an effort to combat resulting high maintenance costs in industrial furnaces from improperly matched mortars and brick.

The 16-page bulletin contains description and data on products offered for furnace savings. **Contact Manufacturer: Mexico Refractories Co., Div. of Kaiser Aluminum & Chemical Corp., Mexico, Mo., for Cements, Mortars, Coatings bulletin.**

Small valves for general use

. . . are outlined in Section N of new Catalog KS-1. The four-page section presents information pertaining to valve working pressures, specifications, construction features, and suggested applications. **Contact Manufacturer: Kerotest Mfg. Co., 2525 Liberty Avenue, Pittsburgh 22, for Section N, Catalog KS-1.**

Method of welding electrical connections

. . . to copper and steel is outlined and illustrated in a four-page bulletin on the Thermoweld process. The low-cost process forms a solid-copper fusion weld of higher conductivity than the cable itself and impervious to moisture or corrosion, the literature reveals. **Contact Manufacturer: Burndy Corp., Norwalk 3, Conn., for Thermoweld bulletin.**

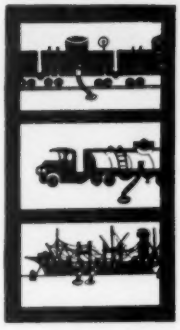
Nylon valve and seat

. . . for high-speed reciprocating pumps is described in a new available catalog. The unit features a safety-lock snap ring and new retainer, along with an optional dual spring. The keeper and snap-ring arrangement eliminates all threaded connections and simplifies correct assembly of the parts, according to the catalog.

It adds that the dual concentric spring enables more spring material to be used in the limited space, allowing long spring life and more efficient high-speed operation. **Contact Manufacturer: Line Scale Co., Inc., P. O. Box 7353, Oklahoma City, Okla., for Nylon Valve and Seat Application Catalog.**

FUELING MADE EASY

with ROYLYN "Non-Spill" COUPLING VALVE



From tank car to tank . . . from tank to truck or ship . . . from tank to tank . . . this "quick" coupling-valve simplifies loading, filling or transfer of petroleum, petro-chemicals and other fluids.

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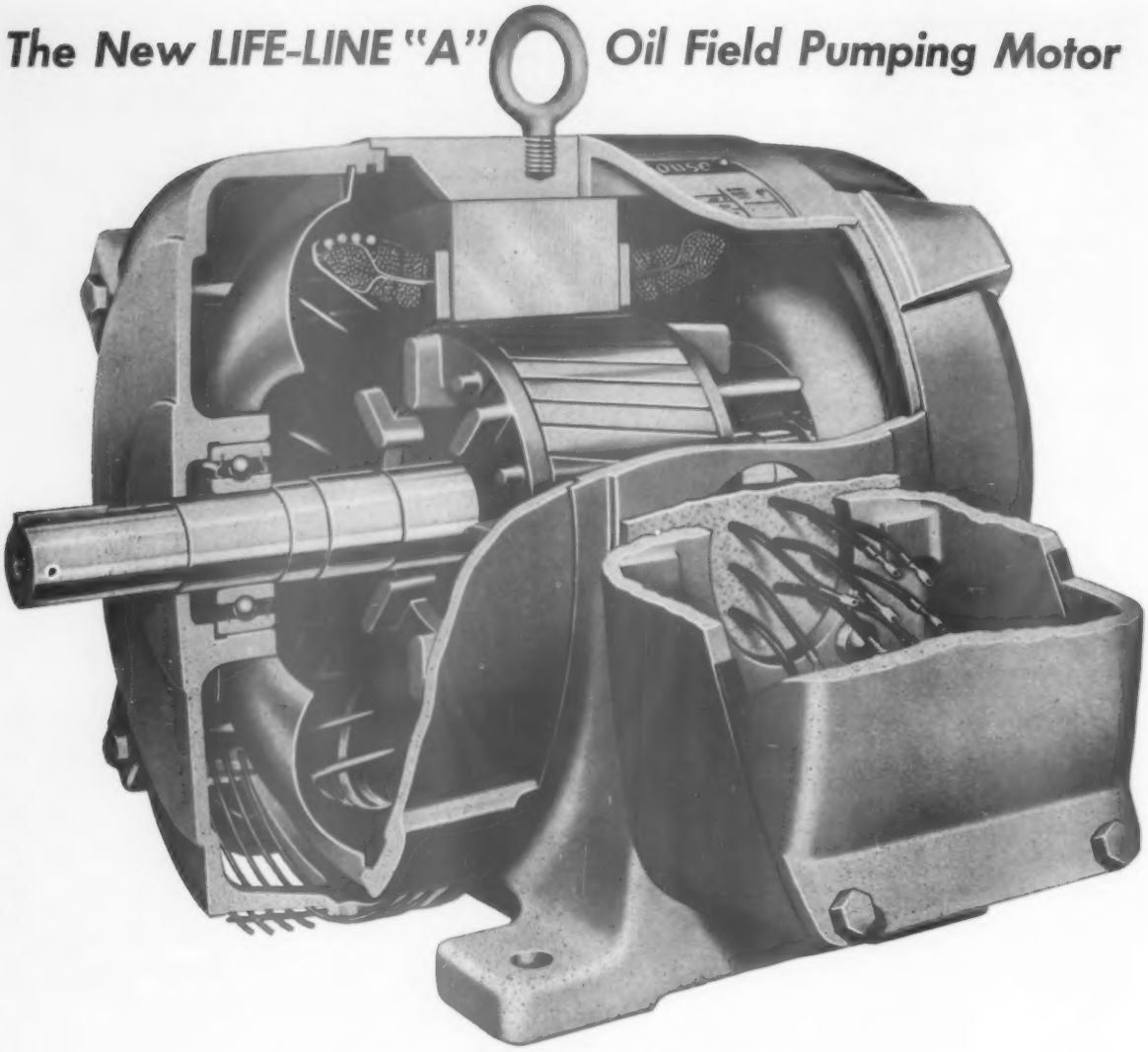
The New LIFE-LINE "A" Oil Field Pumping Motor



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- Extra capacity for unusual load demand
- Peak performance for wide range of voltages
- High starting torque for positive breakaway

The balanced design of the new Westinghouse oil field pumping motor assures you of reliable performance under any conditions. Built especially for oil field pumping service, this new Westinghouse motor's extra capacity will meet *any* unusual load demands. Its 40° C rise gives you long insulation life and the extra temperature margin needed to handle the short-time overloads often present in this type of operation. Low magnetizing current assures high power factor for the entire voltage range. Starting torque, too, at 10 percent below rated voltage is higher than NEMA C requirements and is great enough to assure breakaway even under icing conditions.

In addition to performance, this new motor is mechanically protected with antirodent screens, special baffling to protect against splashing liquids, gasketed cast-iron conduit boxes, and eyebolts in all frame sizes.

For complete information call your nearest Westinghouse sales office, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-22105

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C. L. (Hal) Roach is elected

C. L. Roach

. . . vice president in charge of all domestic operations of Houston Oil Field Materials Co., announces Hugh Q. Buck, president. Roach has served in many administrative and executive capacities during his 25 years with the company. He was in charge of Oil Equipment, Ltd., Homco's Canadian affiliate, prior to this appointment.

Warren Hollier

E. C. Alford

Meanwhile, Homco announced six division-manager appointments. Warren Hollier, with headquarters in Casper, Wyo., will take over the Rocky Mountain area. A 12-year company employe, Hollier has been in the Rocky Mountain district for the past 6 years. The new Western Louisiana division manager is E. C. Alford. He will headquarter at Lafayette, La. Alford has been in the area since 1943 and joined Homco 11 years ago as district manager in New Iberia.

R. M. Freeman

D. J. Erwin

Gene Webb

Don Burton

R. M. (Wimpy) Freeman takes over the South Texas division with headquarters in Alice, Tex. He has been with the concern 20 years and has held various supervisory and administrative positions. The new West Texas and New Mexico division manager is D. J. Erwin. A 15-year company veteran, he will locate in Odessa, Tex. Erwin, who formerly served as division manager of services in Louisiana, was manager of export sales in Homco's New York offices prior to this appointment.

Gene Webb, with headquarters in New Orleans, assumes the title of Eastern Louisiana and Mississippi division manager. He previously was with Oil Equipment, Ltd. Don Burton, who will reside in Oklahoma City, is the newly named manager of the North-Central division. He formerly was with Associated Oil Field Rentals.

Robert W. Kerr is elected

. . . president of Fairbanks, Morse & Co., succeeding Robert H. Morse, Jr. Morse was named vice chairman of the board.

The new president is also vice president in charge of subsidiary operations for the parent company—Fairbanks Whitney Corp. Kerr previously served 5 years as vice president and group executive of American Machine & Foundry Co., and with Bingham-Herbrand Corp. of Toledo, Ohio, holding the post of president and chief executive officer, as well as director during the past 3 years. Earlier he had been executive vice president and director of Plomb Tool Co., Los Angeles.

Meanwhile, Frank H. Cankar, who recently joined Fairbanks-Morse, was elected to the newly created post of vice president in charge of administration.

M. J. Crose Mfg. to distribute

. . . the complete line of Johns-Manville fiber-glass pipeline products in addition to J-M asbestos felts previously handled, according to Clare Miller, president. The J-M fiber-glass line was formerly manufactured by L.O.F. Glass Fibers Co., which recently merged with Johns-Manville.

Mid-Continent Supply names

. . . a new district sales representative in the Fort Worth office (Alan A. Pike), and a new store manager at Duncan, Okla. (George N. Magee).

Pike, former district manager at Casper, Wyo., joined Mid-Continent in Kermit, Tex. in 1948. During his Mid-Continent tenure, he has served as a field sales representative, store manager, and city sales representative.

Magee began with Mid-Continent in 1950 at Sundown, Tex. He served as a field sales representative and city sales representative before his new promotion.

W. C. Talbert is named director

W. C. Talbert

. . . of foreign sales for Mission Mfg. Co. with headquarters in Houston, reports Mission President Richard E. White. Talbert's recent assignment was sales manager of Mission Mfg. Co., Ltd., with offices in London. Talbert's prior Mission experience includes 2 years as Gulf Coast technical-service engineer and 2 years as Venezuela technical-service engineer. He was Mission Mfg. Co., Ltd.'s sales manager for 3 years.

Pipeline Division of Continental

D. S. Nunally

. . . Tapes is formed to enter the protective-coating tape field, announces Guy F. Lipscomb, Jr., president of the South Carolina firm.

At the same time, Lipscomb made known the appointment of Dell S. Nunally, a veteran in the pipeline protective-coating field, as division sales head.

Nunally has been working most recently as a manufacturer's agent for pipeline materials in Houston, following several years of experience with Polyken Sales Division of Kendall Co.

Vinson Supply starts erection

. . . of a half-million-dollar office-warehouse facility in Houston, announces Bailie W. Vinson, president and chairman of the board. The new project will be located on four acres of ground adjacent to the existing facilities. Complete stocks of pipe, valves, fittings, and oil-country tubular goods will be warehoused in the new facility, which will be supervised

by John H. Heinzerling, vice president in charge of the Houston area.

Oil Well Supply appoints two

Allen C. Johnstone has been named field representative at Edmonton, Alta., reports W. A. Weir, Canadian area manager of the division. Johnstone was employed by Oilwell in 1954 at Edmonton, and was transferred to Drayton Valley, Alta. as field representative in 1956. He was located in Drayton Valley at the time of his new appointment.

Clinton L. Benezette has been appointed sales office manager at Mt. Pleasant, Mich., according to J. P. O'Toole, the division's Eastern area manager. Benezette started with the firm 35 years ago at Bolivar, N. Y. In 1944 he was named district manager at Mt. Pleasant, the post held prior to the appointment.

John O. Moore joins Harley

... Sales Co. as a sales engineer in Oklahoma, Kansas, and Texas. He will locate in Tulsa. Moore was a sales engineer for Worthington Corp. before starting with Harley.

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GENERATORS ARE

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The new Needles, California Compressor Station operates with quiet efficiency. Maxim Silencers cut down exhaust noise and intake pulsation to the minimum. Specify the world's most widely used silencer—a Maxim. There's no quiet like *Maxim-Quiet*.

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Officials talk prior to purchase

R. C. Schenk (left), president of Maloney-Crawford Tank & Mfg. Co., Tulsa, confers with John A. Morgan, president of Butler Mfg. Co., Kansas City, Mo., before the purchase of Butler's Union Tank Division by Maloney-Crawford. The sale moves Maloney-Crawford into third place nationally in it's field, and greatly expands the engineering and product lines of the 50-year-old company.

New air service opens gateway

... to Canada from southwest as Western Air Lines inaugurates direct air service between Denver and Calgary, Alta.

Western now operates daily DC-6B flights to Calgary, and Braniff Airways' schedules from Houston, San Antonio, Dallas, Fort Worth, and Oklahoma City make connections in Denver with the new service.

R. S. Ousterhout to supervise

... The Dallas-Fort Worth sales offices of Dowell Division of The Dow Chemical Co., according to B. E. McCann, general sales manager. Ousterhout, the division's assistant general sales manager, will locate in Dallas.

Ousterhout joined Dowell in 1943 in the firm's Tulsa chemical lab. Several years' field experience in Oklahoma and West Texas followed, after which he became area manager at Odessa in 1950.

He later was transferred to Permian Basin district headquarters in Midland, Tex. to work in the sales department. Two-years later he became district sales manager at Midland, and in 1953 moved to the company's general offices in Tulsa. Ousterhout has been assistant general sales manager since 1957.

Meanwhile, C. R. Olson, who has

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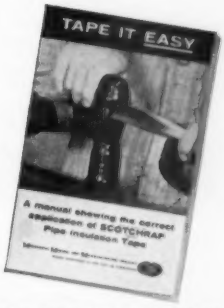

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5. Minimized swabbing action when pulling bit.
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All main shaft and swing clutches on the 22-B Hi-WALKER are identical and their parts interchangeable. You don't need to carry along an expensive parts stock . . . one set of bands is your reserve.

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been in the Dallas office since 1955, will move to the Calgary, Alta. head office of Dowell of Canada, Ltd. W. C. Atkin is transferring from Calgary to Dowell's general office in Tulsa, where he will join the industrial-sales department.

L. J. Troutz is elected president

L. J. Troutz

. . . of Cummins Sales & Service, Inc., reports Ken W. Davis, chairman of the board. Before the election, Troutz was vice president and general manager of the Fort Worth firm.

Troutz joined the organization 16 years ago at Odessa, Tex. He was promoted to service manager there before moving to the Fort Worth general office as general service manager. He was named vice president and general manager last year.

A. R. (Pat) Patton is appointed

A. R. Patton

. . . special sales representative for Security Engineering Division, Dallas rock bit and oil-well drilling-tool manufacturer. The announcement comes from Claude L. Griffin, vice president of sales.

Patton worked for Halliburton Oil Well Cementing Co. in Oklahoma before being transferred to South America in 1953. He later joined Security International C. A. as district sales manager for Eastern Venezuela.

Patton will maintain offices in New Orleans and will work primarily in Southern Louisiana, Mississippi, and Alabama.

I. W. Shaw is elected v. p.

. . . in charge of production of Tex-Tube, Inc. Formerly, he was the company's manager of operations.

Shaw, who joined Tex-Tube 2 years ago as production manager, previously was with Ford Motor Co., Standard Tube Co., and Republic Steel Co.

Donald Black is made manager

. . . Houston division, by Fischer & Porter Co. Formerly a field engineer at the F&P Detroit office, Black is a mechanical engineer.

Oilwell makes three changes

. . . according to M. F. Jones, Gulf Coast area manager of Oil Well Supply Division, U. S. Steel Corp.

Gerrett A. Klatt, Jr., has been named store manager at Alice, Tex. Klatt was employed by Oilwell at Alice in August 1952. He was transferred to Victoria, Tex., as field representative 2 years later.

Joseph P. Deroche has been transferred from Houma to New Iberia, La., as a field representative. Deroche began with the company 3 years ago at Houma. He was made field representative there last year.

Warner D. Thamm is the new field representative at Victoria, Tex. He was employed by Oilwell in 1952.

Expansion plans for 1959

. . . have been announced by Tex-Tube, Inc. Specifications are being drawn for a two-story addition to the present office building in Houston. The present 6,000 sq. ft. of office space will be more than doubled.

In addition, two upsetters for the manufacture of oil-well tubing and three normalizing furnaces for heat treatment of oil-country steel are being installed in the plant.

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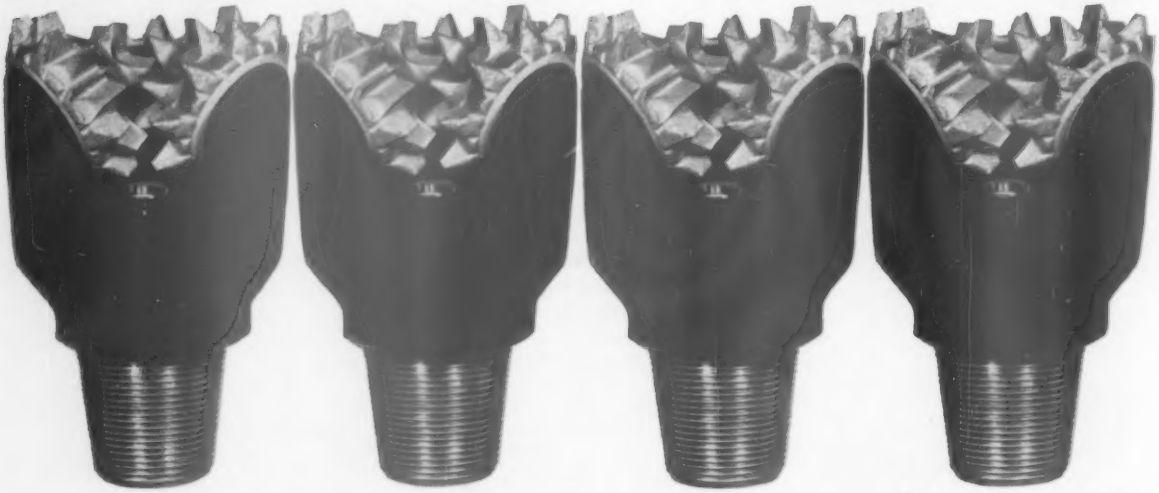

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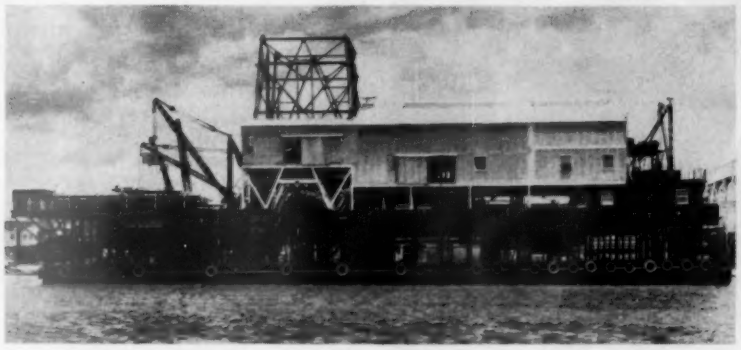

New barge clears ways in Texas

Nicklos Drilling Co., Houston, will operate a new submersible drilling barge recently completed for McNisco, Inc., Houston. Named the "Don McMahon" in honor of McNisco's president, the new equipment was built by Levingston Shipbuilding Co. of Orange, Tex.

The new vessel departed for location where Nicklos will drill for Texaco, Inc., 3 Mount Point, State Lease 340 in the Gulf of Mexico, off Iberia Parish, Louisiana, 3 miles from land. The first well is scheduled for a depth of 16,000 ft.

The "Don McMahon" is designed, constructed, and equipped to drill depths greater than 20,000 ft. The barge measures 188 by 50 by 12 ft. and is outfitted with the latest drilling tools. The rig is an Ideal Consolidated Type 130, powered by three Superior PTDS-8 engines. Two National G1000B and an auxiliary Ideal slush pump C-250 are compounded to give maximum mud pump efficiency.

The barge increases the number of McNisco rigs to 11. The company operates along the Gulf Coast area. McNisco officials include: Don McMahon, president; Gordon E. Nicklos, vice president, and K. R. Simmons, vice president in charge of operations.

Soft-stepping giant

A mammoth machine that treads more softly than a man is helping the oil industry to lick tough muskeg country. Leaving the city last week on an assignment for Imperial Oil, Ltd., northwest of Edson, Alta., was a 160-ton truck. The $15,000 tandem-track vehicle was manufactured by Spalding Drilling Co., Ltd., of Calgary. With its attached shot-hole rig, value of the unit is about $35,000.

The unit treads more softly on muskeg than the average man. A man places about 5 to 8 lb. of pressure per sq. in. on muskeg, while the track vehicle exerts only about 1½ lb. per sq. in. on the muskeg.

The 160-hp. giant is the second to be built here by the Spalding firm. Two more such units are contemplated. The attached shot-hole rig can use either air or water, enabling it to operate when water supplies are too distant, or the water is frozen.

J. E. Spalding, president of the firm which built the track vehicle, said similar vehicles previously constructed dig too deeply into the muskeg when making a turn. His vehicle is designed to jack-knife on a turn, leaving the muskeg undisturbed. He compares muskeg to a floor carpet—when something with pressure concentrated on a limited area is slid across, the carpet tends to buckle and halt progress. This problem has now been overcome.

Etex servicing company formed

The formation of Macworth Oil Well Servicing & Drilling Co. has been announced by E. J. McBride and R. G. Worthy, owners. The new firm, headquartering in Tyler, Tex., will specialize in well-servicing, workover, rods, tubing, swabbing, and well completion. For the time being, Macworth will concentrate its operation in the East Texas and western Louisiana areas.

McBride has been active in the drilling industry for 31 years. For the past 10 years he has been associated with Delta Drilling Co. as a tool pusher. Before that time, he was

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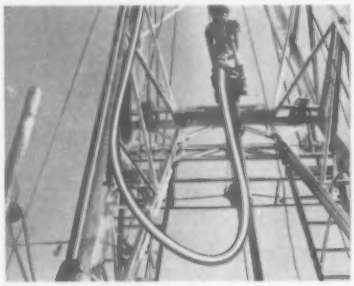
Insist on Thermoid Brake Blocks on your original equipment, and when making replacements. Talk to the Thermoid distributor, or write *Thermoid Division, H. K. Porter Company, Inc., Tacony & Comly Sts., Philadelphia 24, Pa.*



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with other drilling contractors in Dallas and Wichita Falls.

Canada's largest gets larger

Cody R. Spencer, president of General Petroleums Drilling Co., Ltd., and John A. Scrymgeour, president of Commonwealth Petroleum, Ltd., jointly announced that Commonwealth had acquired a financial interest in General Petroleums.

Commonwealth, Ltd., a holding company whose subsidiary, Commonwealth Drilling Co., Ltd., is Canada's largest oil-field drilling firm, and through this arrangement obtains a financial interest in an additional 20 drilling rigs owned by General Petroleums.

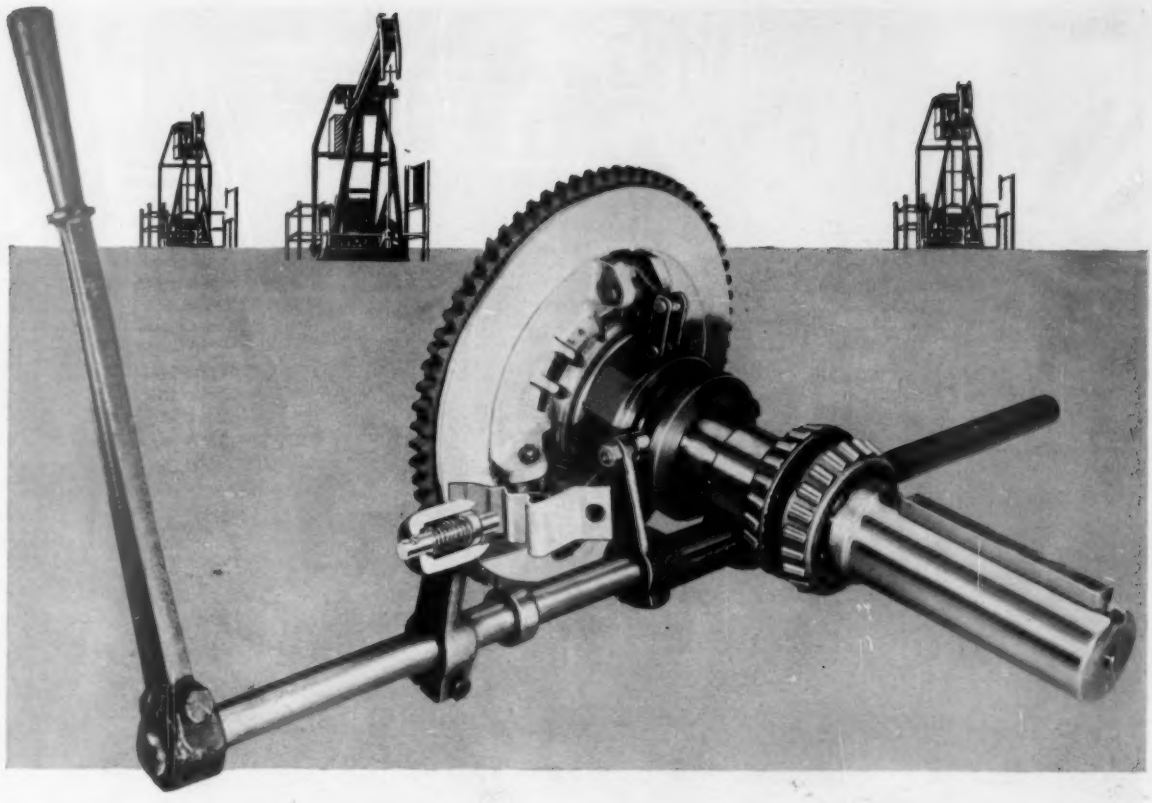
Spencer stated that no change is contemplated in the administration or operations but that Commonwealth and General Petroleums are examining areas where their over-all facilities could provide better service to the industry.

Commonwealth Drilling maintains its shop and maintenance facilities in Edmonton, with head office in Calgary, while General Petroleums has recently completed new maintenance and shop facilities in the Highfield district of southwest Calgary.

All-American rig to Argentina

Santa Fe Drilling Co., Santa Fe Springs, Calif., has contracted for Union Oil Co. of California's first Argentina test. A ship load of drilling equipment is en route from Houston to Puerto Deseado, Argentina. This seaport is approximately 1,000 miles south of Buenos Aires, close to the Antarctic Circle. Union has a 27-year contract for exclusive exploration and development of two blocks totaling 4 million acres in the provinces of Chabut and Santa Cruz.

The rig and equipment were the result of coordinated liaison of several American manufacturers. The draw works were built in California, the derrick in Oklahoma, engines in Detroit, pumps in Chicago, camp trailers in Denver, drill pipe in Pittsburgh, and hundreds of other items made throughout the U. S. were shipped to the Texas seaport. The individual components numbered over 6,000 that were put aboard the freighter. Before loading the entire rig and portable camp were assembled in Houston for final checking, and then disassembled for loading. The isolated location of the drill site necessitated full testing and complete winterizing of the rig for year-round operation.



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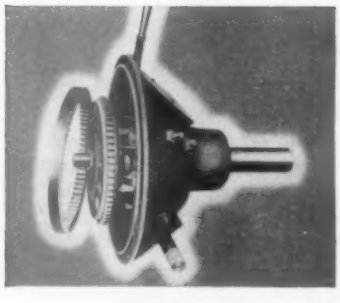

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- **Will pay for itself in labor savings alone**

Daily greasing of PTO clutch throw-out collars is not only a nuisance but, in cases where pumping jacks are widely-scattered, a heavy expense item as well. Twin Disc has solved this problem with a new clutch engagement mechanism that virtually eliminates throw-out collar wear, ending daily greasing for good.

Here's how it works: Two sealed cam followers ride in an annular groove machined into the sliding clutch sleeve. When the hand lever is pushed forward, the cam followers exert a forward thrust on the sliding sleeve. As the clutch linkage passes through top dead center, over-center action snaps the sliding sleeve slightly forward. At this instant, a contoured detent (bolted to the housing) checks the forward movement of the cam followers, assuring positive clearance.

There's no wear on the throw-out mechanism in the fully disengaged position because there's no contact between cam followers and sliding sleeve. Cam followers rotate *only* when the clutch is being engaged or disengaged.

In oilfield pumping service, the advantage of this design feature is obvious . . . instead of once a day, PTO greasing is needed only once every six months. The savings you realize in time and labor costs can easily amount to thousands of dollars a year.

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DIACEL A—A special type of sodium silicate accelerator. It permits placement of low water loss cements over a greater range of temperatures.

For complete details and technical literature, contact your Drilling Specialties field engineer . . . or your cement service company.

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Bartlesville, Oklahoma

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Ordovician play spreads in Michigan

BY FRANK J. GARDNER

THE HEAT'S ON AGAIN in southern Michigan. Once more, an apparently successful wildcat has drawn industry attention to the productive possibilities of the Trenton-Black River (Ordovician) formation, least-explored and best-bet reservoir in the Wolverine State.

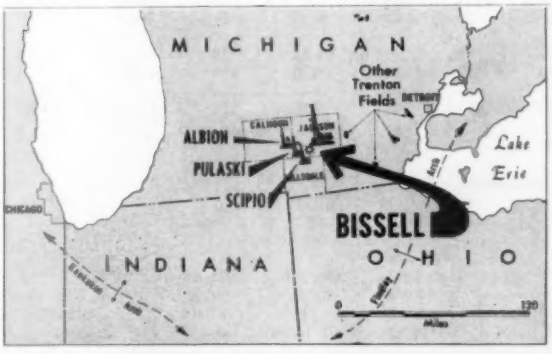
One long trend . . . First heat in this southern part of the Michigan basin was generated in 1957 and 1958, with the discovery of Scipio field in northwestern Hillsdale County. The first well, a hit-or-miss operation that was 18 months in the drilling, was C. A. Perry 1 Houseknecht (Scipio Township, 10-5s-3w); it was finished in January 1957 as a 150-bbl. well producing from Trenton-Black River at 3,576 ft. But Scipio didn't really hit the headlines until September of that year, when Aurora Gasoline Co. and McClure Oil Co. 1 Stevens, fourth Scipio well, blew out and flowed 2,400 bbl. daily. A wave of leasing and drilling followed.

Then, in December 1958 a second wildcat strike 12 miles northwest of Scipio, made 296 bbl. of oil on 24/64-in. choke from Trenton-Black River at 4,090 ft. This was Mask & McClure 1 Rosenau, in southeastern Calhoun County (Albion Township, 23-3s-4w).

To nail down a northwest-southeast trend now expected to grow to 20 miles in length, a third wildcat hit oil in the Trenton-Black River in February of this year. This one was about midway between the Scipio and Albion fields (Pulaski Township, 20-4s-3w), and brought southwestern Jackson County into the picture. It was a Turner Petroleum Corp. operation, the 1 Blair. It turned in a potential of 265 bbl. in 22 hours, using a 10/64-in. choke. Pay zone was 3,820-32 ft.

Little time has been lost in developing this fairway stretching across three counties. Scipio, the original find, now has 25 wells producing more than half a million barrels yearly, while Albion has six wells making 500 bbl. a day. Development is getting under way at Pulaski; here, a 1¼-mile north extension has been reported at Aurora, Ohio, & McClure 1 Bartell (Section 7-4s-3w). The well flowed 59 bbl. in 1 hour on 1-in. choke after perforating Trenton-Black River at 4,196-4,200 ft. This is one of the best flows yet recorded along the trend, and may well presage a linkup between Albion and Pulaski fields.

Today, at least two dozen new locations have been staked in the three-field fairway, and half of these are already drilling.



SOUTHERN MICHIGAN added a new field to its Ordovician play last week. Indicated success at the Bell & Gault 1 Bissell (arrow) is the first to be found in a possible new trend parallel to the prolific Scipio-Pulaski-Albion belt of production.

Leads to another . . . As leases along the trend became scarce and prices soared, southern Michigan operators began to use a little imagination. The Scipio-Pulaski-Albion wells lay within and on the flanks of a structural low, delineated on either side by gravity highs. Why, in this region of many known gravity highs, shouldn't there be other favorable areas for similar fairways? So the lease play spread to outlying townships.

Today, these operators believe a second trend **has** been spotted. And well it might. Another team of Jackson County wildcatters has announced preliminary success at a well 7 miles due east of Pulaski field. Bell & Gault 1 Bissell (Hanover Township, 8-4s-2w). reported gas flow of 3,840 M.c.f. per day in Trenton dolomite at 3,989-4,012 ft. The Trenton was logged here at 3,825 ft. The pay zone is believed to correspond to the gas cap of the big trend, and the operators will carry the well deeper in the search for Trenton-Black River oil. At last report, the operation was hampered by circulation trouble. But a new wave of leasing has been set off.

This first success off the beaten path indicates the prize that lies in store for Ordovician explorers all along the southern flank of the Michigan basin. A systematic approach to spotting these trends might well serve to revitalize the entire Michigan industry. Production depends on isolating fractured dolomitized zones associated with the flanks of low-relief structures plunging to the northwest. These have been successfully outlined by gravity surveys. But finding the fracture zones is expensive business. Some of the best producers are structurally low to the driest dusters.

Michigan operators are confident, however, that more Scipio trends are in the offing. And their neighbors in northeastern Indiana and northwestern Ohio might do well to take a look at the Trenton-Black River in **their** backyards.

How successful are gas-well discoveries?

Not very, according to the Committee on Statistics of Exploratory Drilling. But still, more successful than in oil exploration. This AAPG committee, under the chairmanship of Gulf Oil Corp.'s B. W. Blanpied, Shreveport, has just released its first study on the subject.

BLANPIED

ONLY ABOUT 45% of the so-called "successful" gas discoveries in this country result in reserves that may be considered profitable. This is the principal conclusion drawn from a newly completed study of gas wildcatting during the decade 1943-53 by the Committee on Statistics of Exploratory Drilling of the AAPG.

In its first attempt to analyze the natural-gas reserves resulting from successful new-field wildcat completions, the committee took its cue from an original study made in 1958 by Dr. Frederic H. Lahee, Dallas consultant (The Oil and Gas Journal, Aug. 4, 1958, p. 97). The CSED, under the chairmanship of Gulf Oil Corp.'s Dr. B. W. Blanpied, has made a similar analysis of oil reserves as part of its annual report for many years. But this is the first time they have taken a look at gas and tried to credit reserves to the year of discovery of individual fields.

The original Lahee report covered the years 1943-52, inclusive, and allowed at least 4 years (Dec. 31, 1952, to Jan. 1, 1957) for development history. The CSED makes a similar anal-

TABLE 1—STATISTICS OF NEW-FIELD WILDCATS IN 17-STATE AREA, AS REPORTED AT END OF YEAR OF COMPLETION

	1	2	3	4	5	6	7	8	9	10
	Successful completions									
Year drilled	Oil	Gas	Gas-cond.	Total gas wells (gas & gas-cond. Col. 2+ Col. 3)	Total wells (Cols. 1+2+3)	Per cent of gas wells in total wells (Col. 4/ Col. 5)	Dry holes	Total new-field wildcats (Col. 5+ Col. 7)	Per cent successful wells (Col. 5/ Col. 8)	Ratio, one success to every wildcat (Col. 8/ Col. 5)
1952	549	103	68	171	720	23.75	5,720	6,440	11.18	8.94
1953	568	115	53	168	736	22.83	5,886	6,622	11.12	8.99
1954	627	175	75	250	877	28.51	6,158	7,035	12.46	8.02
1955	646	145	81	226	872	25.91	6,866	7,738	11.27	8.87
1956	617	140	90	230	847	27.13	7,556	8,403	10.04	9.96
1957	562	158	110	268	830	32.30	6,781	7,611	10.91	9.17
1958	499	169	92	261	760	34.32	5,858	6,618	11.48	8.71
Total	4,068	1,005	569	1,574	5,642	27.92	44,825	50,467	11.17	8.95

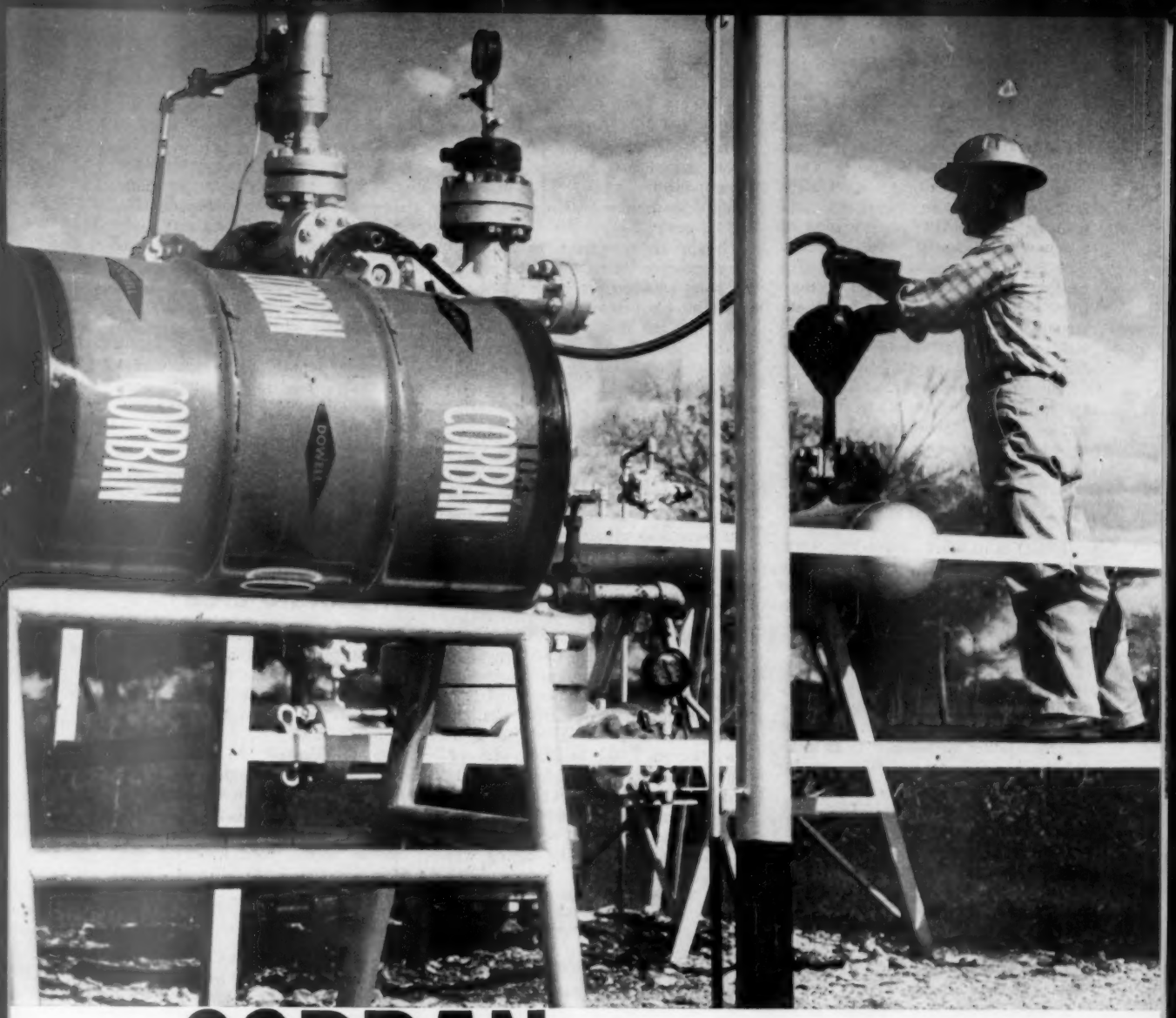
TABLE 2—STATISTICS ON GAS DISCOVERIES

	1	2	3	4	5	6	7	8	9	10	11	12
	Estimated total ultimate recoverable reserves after 5 to 6 years of development history											
	A	B	A+B	C	A+B+C	D	E	A to E incl.	E+F	F	A to F incl.	F divided by A to F incl. (%)
1953	5	3	8	3	11	18	70	99	84	14	113	12.38
*1943-1952	51	44	95	81	176	314	377	867	536	159	1,026	15.50
Combined total	56	47	103	84	187	332	447	966	620	173	1,139	15.20

*From figures compiled by Dr. F. H. Lahee, AAPG Bulletin, Sept. 1958.

TABLE 2 (Continued)

	13	14	15	16	17	18	19	20
			% and No. fields with outlet					
	Consol. field discoveries	Col. 8+ Col. 13	D fields	E fields	Profitable gas fields (A+B +C+D fields)	Unprofitable gas fields (E+F fields)	Unprofitable gas fields, total %	Profitable/ unprof. disc.
1953	10	109	72.25% 13	55.8% 39	29	84	74.30	1 to 2.895
1943-1952	55	922	(?)	(?)	490	536	52.25	1 to 1.094
Combined total	65	1,031			519	620	54.49	1 to 1.194



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ysis of 1953 discoveries with reserve estimates as of January 1, 1959, thus allowing an expanded period of 5 and 6 years of development history. They considered only gas or gas-condensate fields opened by successful new-field wildcats. The AAPG classification of a new-field wildcat is "an exploratory hole on a geologic structure or in a geologic environment not yet productive. Where such a structure or environment is poorly defined, the new-field wildcat must be several miles from the nearest production."

The first Lahee report of 1958 was the result of a private study and concerned merely gas reserves. It referred to oil reserves where these were related, using the term "oil" for crude oil and condensate. The new study segregates gas condensate as an entity of its own.

CSED in its work covered the same 17 states included in its annual study of exploratory drilling.[1] These states account for more than 95% of all domestic wildcats, production, and reserves.

In its study, the CSED has lumped the total reserves attributable to the original wildcat discovery; i.e., the several pools of a given field are added together to reach a field total. Where there are several pools involving both oil and gas on a structure, a conversion factor of approximately 6 M.c.f. of gas per bbl. of oil has been used to arrive at a classification for total recoverable hydrocarbon reserves. The committee classified its gas fields as follows:

Class A field: 300 billion cubic feet or more.

Class B field: 150-300 billion cubic feet or more.

Class C field: 60-150 billion cubic feet.

Class D field: 6-60 billion cubic feet.

Class E field: less than 6 billion cubic feet.

Class F field: abandoned because of nonprofitability.

At the close of the year of discovery, not enough is known about the physical factors of a field to reach any conclusion about its ultimate reserve, but after several years of development history, such an estimate is believed to be reliable. This is why the current study goes only through the discovery year of 1953.

Some of the more interesting conclusions resulting from this new CSED report are:

- For the 7-year period, 1952-58, an average of 27.9% of all the successful wells (oil and gas) were gas wells with a fairly consistent increase from about 23% in 1953 to more than 34% in 1958.

- Of the 1953 gas strikes, 27.75% of the "D" fields (6 to 60 billion cubic-foot reserve) had no pipeline outlet after nearly 6 years of development history, and 44% of the "E" fields (less than 6 billion cubic feet) had no outlet.

"It appears reasonable to assume," the committee stated, "that the breaking point between profitable and nonprofitable gas fields would be between the "D's" and the "E's" and that, as a rule, fields having reserves of less than 6 billion cubic feet may be considered unprofitable."

- Twenty-nine of the gas fields discovered during 1953 had reserve estimates above 6 billion cubic feet while 84 were unprofitable finds with less than 6 billion. This means that 74.3% of the gas discoveries for that year were unprofitable, or that 2.895 unprofitable strikes were made for each profitable one.

- Over the 10-year period, 1943-53, 54.59% of the discoveries were unprofitable and 1.194 unprofitable strikes were made for each profitable one. The average ratio for profitable oil fields (1944-53) is 3.84 to 1 unprofitable.

"It appears," the committee said, "that much greater success is attained in discoveries of gas fields than in oil."

The first report of the new CSED study will appear in full in the September 1959 issue of the AAPG Bulletin.

References

1. Alabama, Arkansas, California, Colorado, Illinois, Indiana, Kansas, Kentucky, Louisiana, Michigan, Mississippi, Montana, Nebraska, New Mexico, Oklahoma, Texas, Wyoming.

Morrow added to North Buffalo area

IN NORTHWESTERN Oklahoma, Sinclair Oil & Gas Co. has completed a Morrow sand wildcat gas-condensate discovery 2½ miles north of the North Buffalo field in Harper County.

The 1 Rohrer, in SE SW 20-29n-22w, flowed 7,592 M.c.f.d. with 18 bbl. of 54°-gravity condensate daily through a 22/64-in. choke from Morrow perforations at 5,701-11 ft.

The well was drilled to total depth of 7,836 ft., and 5½-in. casing was cemented at 6,018 ft.

The well is the first completed as a producer in the Morrow sand in the North Buffalo field area. Sinclair discovered the multizone field last year.

In North Buffalo field proper, Sinclair dually completed 1 Rogers, SW NW 8-28n-22w.

The well flowed 135 bbl. of 51°-gravity oil daily through a 16/64-in. choke from Lansing lime perforations at 4,592-4,614 ft., and flowed 42 bbl. of 51°-gravity oil daily through a 16/64-in. choke from Arbuckle lime perforations at 7,622-56 and 7,664-87 ft.

Oklahoma's Beaver adds oil producer

First Morrow Pennsylvanian oil production was opened in the South Boyd field area of Beaver County in the Oklahoma Panhandle.

The discovery well, the third producer for the field in the southwestern part of the county, is Sun Oil Co. 1 George S. Sargent in SE NW 13-2n-20eCM, 4 miles southwest of Boyd town. It flowed 350 bbl. of 39.6°-gravity oil and 27 bbl. of salt water in 18 hours from perforations at 7,223-54 ft. The field is made up of a Marmaton oil well, one lower Morrow gas well, and a dual-well making both upper Morrow oil and lower Morrow gas.

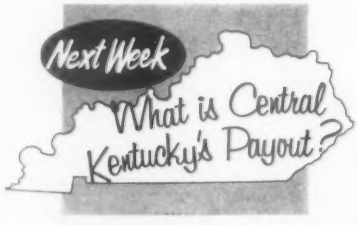
Dual-pay discovery boosts Arkansas reserves

Exploration for additional gas reserves in North Central Arkansas is being given another boost by a new dual-pay discovery 2½ miles northeast of Dover, in Pope County. It is 4½ miles northwest of Moreland gas area, nearest production.

The new discovery well, drilled by Bert Wheeler, is rated good for 13,625 M.c.f.d., open flow, from both zones. Allen sand, perforated at 3,380-3,403 ft., flowed at the rate of 6,500 M.c.f.d. Its deeper Barton sand, perforated at 3,830-53 ft., tested 7,125 M.c.f.d. Bottom-hole shut-in pressures are 1,510 psi. and 1,720 psi., respectively.

Hole was drilled to 4,894 ft., getting basal Atoka sand at 3,990 ft. (surface elevation 575 ft.), Hale sand at 4,189 ft., and Pitkin sand at 4,865 ft.

Location is on Wheeler's Johnson lease, in the NW NW SE 24-9n-20w.



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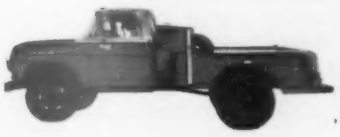

"CONTINUE TO LOOK TO HALLIBURTON—FOR LEADERSHIP"

Wildcat hits pay in Val Verde basin

ONE of West Texas' rank wildcats reported a flow of oil from Pennsylvanian perforations, after showing for a small gasser in the Devonian.

Shell Oil Co. and Humble Oil & Refining Co. 1 J. E. Smith, 4½ miles southwest of Sheffield, in extreme northern Terrell County, perforated in the Pennsylvanian at 8,108-17, 8,127-29, and 8,144-49 ft. After swabbing 32 bbl. of oil and 12 bbl. of water, the well kicked off and flowed 36 bbl. of oil plus 12 bbl. of water in 4 hours through 34/64-in. choke. During the next 13 hours it flowed 132 bbl. of oil through ¼-in. choke.

Previously the well made gas flows up to 3 M.M.c.f.d. from Devonian perforations between 8,586-8,695 ft. Total depth was 10,292 ft., plugged back to 8,781 ft.

The well is in Section 5, Block A-2, TCRR Survey, 8 miles southwest of Halff field (shallow Permian) in Crockett County and 18 miles north of Brown-Basset field in eastern Terrell County. Elevation of the well is 2,317 ft. Formation tops are the Strawn at 8,006 ft., and Devonian at 8,315 ft.

Deep wildcat scheduled for Grayson County

A 13,500-ft. wildcat has been announced for northwest Grayson County by The Grande Corp., of Dallas. Location for 1 T. W. Harshbarger Unit has been staked in the Reuben Alexander Survey, A-19, 6 miles northwest of Pottsboro. The project is on a 704-acre lease, 5 miles north of nearest production in Northeast McMillan field. It is also 1 mile northwest of a 5,129-ft. dry hole.

Sun Oil Co. 1 H. P. Boren is a 5,500-ft. wildcat in southwest Grayson County, 4 miles northeast of Collinsville. It is in the James M. Thomas Survey, 2 miles south of McElreath field, but separated by a 5,305-ft. dry hole.

Heavy flow gaged in Palo Pinto field well

A heavy flow of gas and condensate was reported from the third well in Palo Pinto County's recently opened field five miles northeast of Palo Pinto townsite.

The test is Skelly Oil Co. 2 Rhodes, Section 2, Block 1, T&P Survey. Following a fracture treatment of 10,000 gal. of oil and 10,000 lb. of sand at 4,298-4,314 ft., the well flowed at the rate of 46 M.M.c.f.d. of gas, plus 635 bbl. of condensate. The flow was through open 2-in. tubing. Total depth was 4,388 ft., plugged back to 4,350 ft. Shut-in pressure was 2,055 psi.

The new field has been designated Palo Pinto-Conglomerate.

Prolific gas well for Texas Gulf Coast

A gas well rated good for 225 M.M.c.f.d. has been brought in as the third producer for the East Mustang area of Jackson County, Texas Gulf Coast. It also opens the third pay zone for the area.

The well is Texkan Oil Co.'s 1 R. C. Burns Unit 1, in the W. D. Sutherland Survey. In Frio pay it was perforated at 5,936-40 ft. Flow through ¼-in. choke was at the rate of 3,587 M.c.f.d. with pressure of 2,207 psi. Liquid (56° gravity) was in the ratio of 1 bbl. to 1,238 M.c.f.

Third Louisiana try hits

The third attempt on the part of Humble Oil & Refining Co. to confirm last year's discovery of production at Donner, in northern Terrebonne Parish, southeastern Louisiana, has proved successful.

Humble's 3-B Lutcher, in 26-16s-15e, tested 144 bbl. of oil per day, flowing through 5/64-in. choke under pressure of 800 psi. Gas flow was 342 M.c.f.d.

The well, drilled to 13,150 ft., is perforated at 12,710-18 ft., but is potentially productive from several other zones, and may be completed dually later.

Discovery well, 1-B Lutcher-Moore, was dually completed in pays at 12,664-74 ft. and 12,504-10 ft. Since its completion, Humble's 2-B Lutcher-Moore, north of the discovery well, and 1 Boudreaux, 1½ miles east, have been drilled as dry holes.

Wind River basin produces gas hit

Wind River basin gas exploration highlights news in the Rockies. Focal point of this activity is in Wyoming's Natrona County where The California Co.'s Cooper Reservoir Unit flowed gas.

On test at 3,664-83 ft. it flowed 5 M.M.c.f.d. Another test at 3,665-79 ft. got 4,900 M.c.f.d., increasing to 7 M.M.c.f.d. Tests are thought to be in Fort Union Tertiary. This Natrona discovery, located in SE SW 3-35n-87w, is slated to test to Basal Wind River at about 4,000 ft. Location is 7½ miles southwest of The California Co.'s Waltman Unit discovery at 1 Unit in NE SW 31-37n-86w. This deep well is below 10,418 ft. Gas flowed at 7,600 M.c.f.d. during tests at 5,887-5,978 ft.

Gas strike brings spurt in Michigan drilling

A strong lease play blossomed on strength of good gas pay in Trenton on Hanover wildcat, Jackson County, 7 miles due east of the Pulaski Trenton oil field.

Bell & Gault 1 Bissell, SE SW NE 8-4s-2w, is first wildcat off the 17-mile-long Scipio-Pulaski-Albion northwest trend to show gas or oil in Trenton in commercial amount. The wildcat logged Trenton at 3,825 (−2,791) and gas pay at 3,989 to 4,012 ft., gaging 3,840 M.c.f. after 6-hour open blow. Efforts so far to quiet well with salt water have not been successful, with formation taking most of fluid in loss zone.

Aurora-Ohio and McClure 1 Bartell, SE SE SE 7-4s-3w, 1¼ miles north of Pulaski pool and 7 miles west of Hanover strike, flowed 59 bbl. oil in 60 minutes on 1-in. choke after perforating Trenton-Black River dolomite from 4,196 to 4,200 ft. with 30 shots. The Bartell had been delayed in testing Trenton for 6 weeks with a thief zone in the Trenton at 4,070 ft. Drill stems above loss point had been calculated at 90 M.M.c.f.d. natural gas. Carter Oil Co. has the bulk of acreage on trend apparently opened by extension.

Drilling in Michigan's Albion waits on ordinance

Albion townsite drilling play, Calhoun County, Michigan, is being held back pending the adoption by the Albion City Council of an ordinance governing within-the-city drilling.

McClure, Rovsek, Palmer and Cummins drilled Trenton production (1 Behling, SE SE NE 4-3s-4w, 160 bbl. in 20 hours) on southwest side of the city with offsets inside the limits. Six locations inside the city are waiting on the ordinance and operators presently figure as many as 25 locations may be drilled.

In preliminary draft the council would prohibit drilling on residential tracts, require state unit spacing of 20-acres, $100 per well permit, $100,000 bond, keeping of storage tanks outside city limits and cementing of

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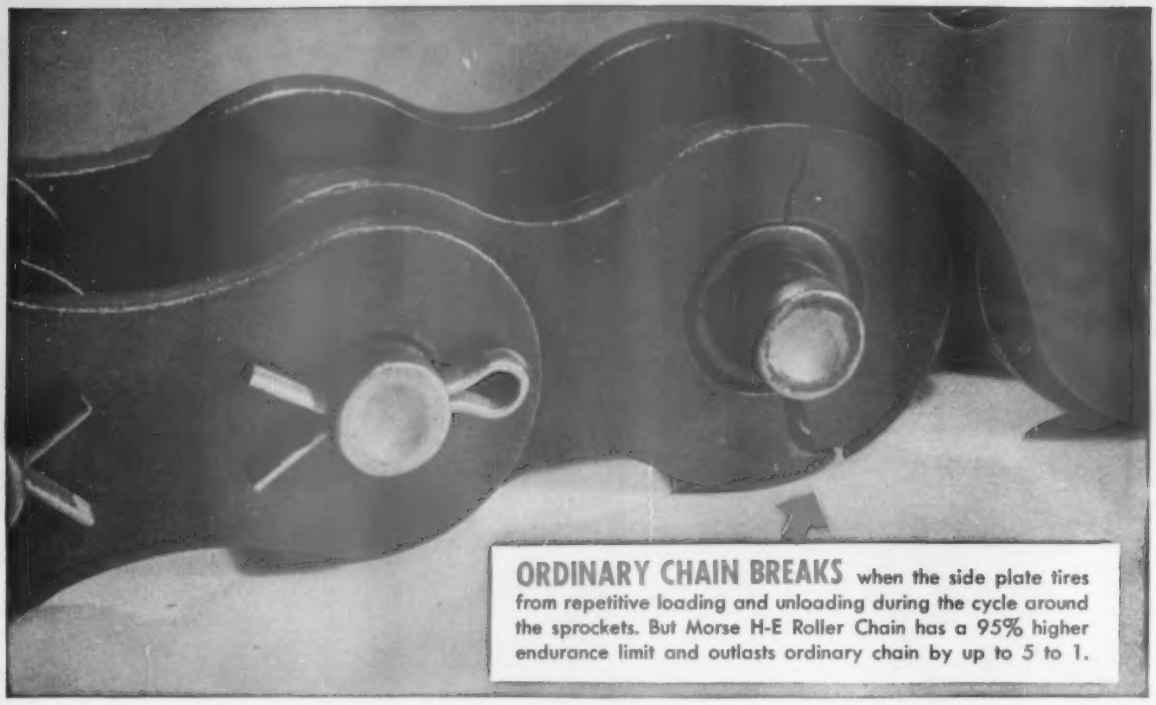

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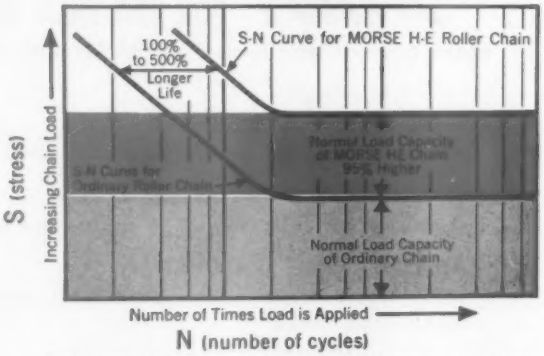
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8-in. casing or larger to a minimum of 1,500 ft. to protect city's 50-200-ft. glacial drift-water supplies.

If approved as now proposed, the ordinance according to some operators, will cost $5,000 and up per well over the field going completion costs, roughly $50,000 a well.

The council plans to offer all or part of about 125 acres of city-owned land for leasing by sealed bids.

SEG Will Offer New Seismic Book

The Society of Exploration Geophysicists, Tulsa, will publish a new 268-page book in July. It is entitled, "Lessons in Seismic Computing," and should be of vital interest to both geologists and geophysicists. It is a direct-approach, well-explained, simply written text which covers the fundamental theories of physics and mathematics used in seismic computations.

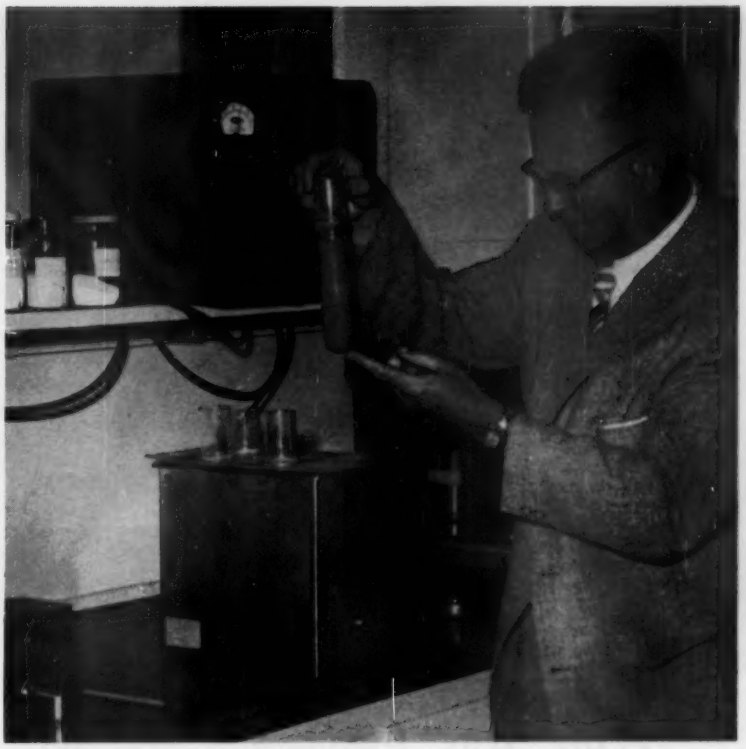
This informative volume was written by the late Dr. Morris M. Slotnick, an eminent teacher, physicist, mathematician, geologist, and geophysicist. These lessons total 44 in number and were written as a series at the request of Humble Oil & Refining Co.

The book will represent two firsts in that it is the first company manual offered to the public, and it is also the first volume to carry computational methods from primary to the advanced stages.

Dr. Slotnick was an exceptional man. He appreciated both the geologist's and the geophysicist's respective viewpoints, having been trained in both fields. It is only fitting that the SEG, through the cooperation of Humble and Mrs. Slotnick, has dedicated this book as a memorial to Dr. Slotnick.

As a teacher, the author realized both the needs and fallacies of the technical man. He said, "The level of mathematical abilities varies greatly among our personnel. We shall strive to meet as many as we can on some common ground. There will be some lessons which at times will render the 'mathematically weak' reader at a loss. He is not to be discouraged for we shall try to overcome such situations by many numerical practice examples and by hewing to the line of practical results."

Not only should the seismic computer benefit greatly from this work, but it will also provide geologists a better understanding of the laws of physics and their techniques as applied in geology.



INSPECTING laundered fossil is Shell's E. H. Stinemeyer.

New machine scrubs fossils

PALEONTOLOGISTS won't have to look through their microscopes quite so hard for fossils hiding in their rock samples.

A new ultrasonic method reduces the amount of material which must be examined and cleans the fossil surfaces so they can be easily identified. The new scrubber was developed by E. H. Stinemeyer, Shell Oil Co. division paleontologist at Bakersfield, Calif.

The crushed, screened samples are placed in test tubes with water, detergent, and various chemicals. Sound waves scrub the clay and silt from the fossils. Sparkling clean sands and fossils emerge from the ultrasonic bath.

Choice of chemicals is a key factor, Stinemeyer says. Various blends are used with different types of samples. The cleaner also is being used in sandstone studies. The scrubber removes the cementing material which holds the grains together, as well as cleaning inaccessible parts of larger fossils.

Two Nevada wildcats active near Las Vegas

Resumption of work on 1 Government Consolidated by Petroleum Engineering Co. and Bonanza Oil Corp. doubled the number of active wildcats in Clark County.

The operators were coring below 3,167 ft. on the wildcat located about 12 miles southwest of Las Vegas.

On the east side of Las Vegas, about 30 miles, Shell Oil Co. was drilling below 3,732 ft. on its 1 Bowl of Fire Unit.

In addition to these two active wildcats, location has been staked for a 7,000-ft. test 10 miles southwest of Las Vegas by the Ard Col Oil Co. No spud date has been announced. Both the Ard Col proposed wildcat and the Bonanza test are associated with the Arden Anticline.

Kansas' Ness opens Pennsylvanian production

Cherokee Pennsylvanian oil production was opened in Ness County, southwestern Kansas, by O. A. Sutton. The 1 Boyd, 10 miles southwest of Ness City and 4 miles northeast of Petersilie Mississippian field, pumped 117 bbl. of oil daily from perforations at 4,278-90 ft. Location is in SE SE SE 25-19s-24w.

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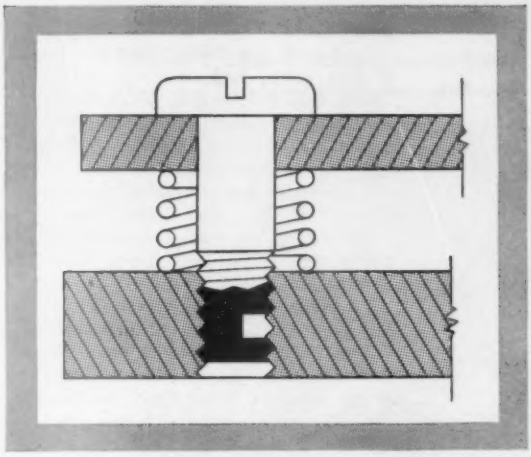

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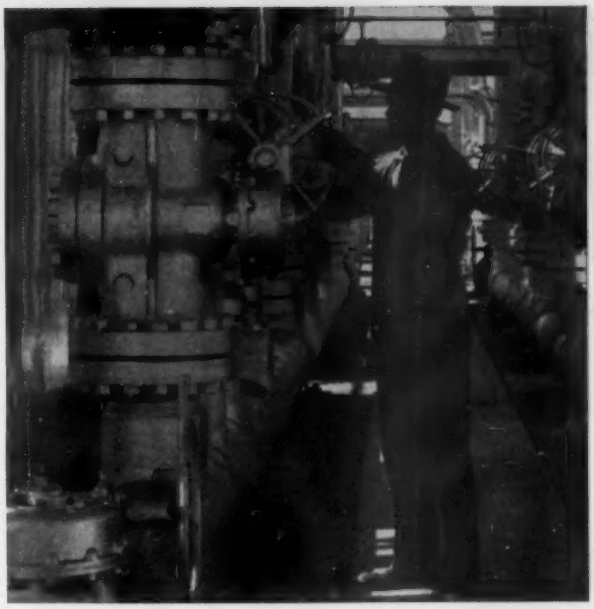

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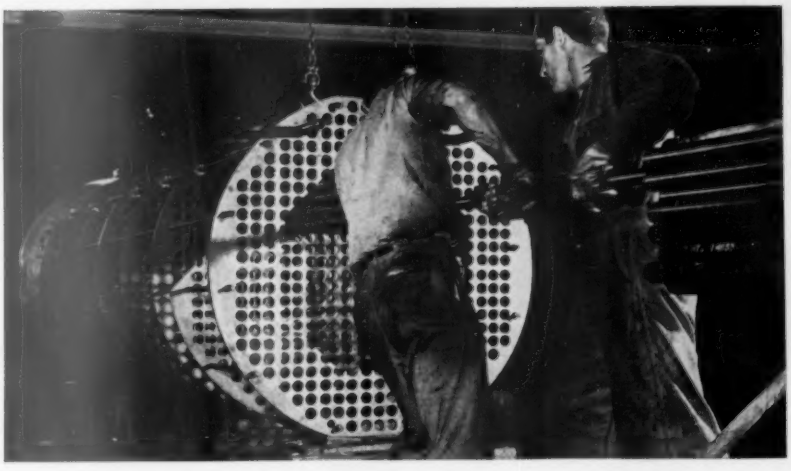

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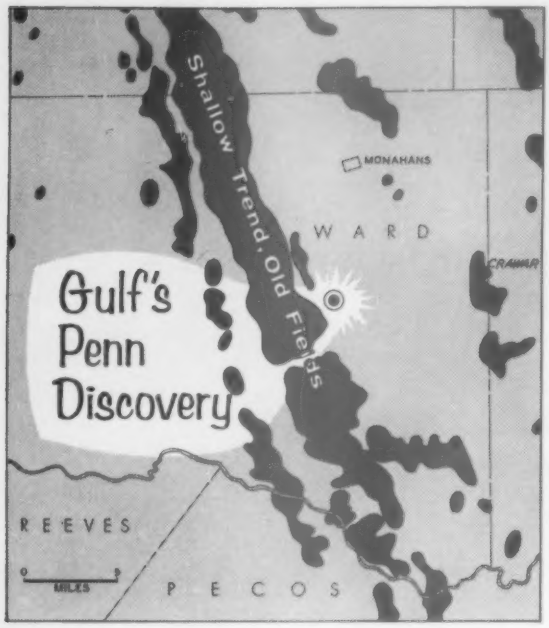


GULF'S 44 W. A. Estes is east of the shallow trend (2,200-2,800 ft.) and 3 miles northeast of a 1957 Pennsylvanian discovery.

Deep find near shallow trend means

New oil for Texas' Ward

AN EXTENSIVE, deep exploration program for new reserves in the old North Ward-Estes area of Ward County, West Texas, last week had all the earmarks of success. Gulf Oil Co. 44 Estes opened flush Pennsylvanian production on the eastern flank of the shallow trend that stretches north-south across the county.

Gulf's second well to find Pennsylvanian production in that area of Ward County, 44 Estes, in NW SE Section 22, Block B-19, PSL Survey, is the first well of such proportions. While drilling, 44 Estes flowed as high as 92 bbl. of oil an hour, with no water, on drill-stem tests of the Pennsylvanian between 7,868-7,936 ft. On completion tests, the well flowed 317.4 bbl. of 37.4° oil in 6 hours through ½-in. choke, to give it a daily potential of 1,269 bbl.

Gulf's previous Pennsylvanian opener in the area was in 1957. No. 166 Estes was drilled in Section 38, Block 34, H&TC Survey. It is 3¼ miles southwest of 44 Estes, and is surrounded by O'Brien (2,250 ft.) production. The 166 Estes apparently was low on structure. It went into the Pennsylvanian at 8,050 ft., and made final perforations at 8,150-8,280 ft. Completion potential was 333 bbl. of oil a day, pumping, plus 53% water. Present allowable for the Estes Block 34 (Pennsylvanian) field is 60 bbl. a day from its only well.

Gulf has had a look at all lower formations in both tests. No. 44 Estes was drilled to 12,890 ft. before plugging back to 8,099 ft., but has not reported formation tops. No. 166 Estes had total depth at 14,100 ft. Pre-Permian markers in this well were the Devonian at 10,980 ft., McKee at 12,710 ft., and the Ellenburger at 13,690 ft. Neither well found more than light shows below the Pennsylvanian beds.

Drilling upsurge due in Alaska

Alaska was experiencing a momentary lull in drilling with the records showing only two active projects. But, every indication pointed to a rapid change in this situation. Here's a rundown on the situation:

... **Anchorage.** Anchorage Gas and Oil Development Co., Inc., was readying a rig for a possible deepening job on the long-idle 6,105-ft. 3 Rosetta about 16 miles north of Anchorage.

... **Capa Yakataga.** Richfield Oil Corp. was waiting on a Clyde Hall Drilling Co., Bakersfield, Calif., rig to start its first test on Cape Yakataga. Spud-in is expected sometime in mid-July.

... **Bristol Bay.** General Petroleum Corp. had the Rowan Drilling Co. rig on a site getting ready to spud in the first test of its acreage in the Egegik-Lake Becharof region of the Alaskan Peninsula.

... **Gubik gas field.** Colorado Oil & Gas Corp. had two rigs at the Gubik Gas field region north of the Arctic Circle ready for a previously announced drilling program. Spud dates were not revealed.

... **Iniskin Bay.** Alaska Consolidated Oil Co. was drilling below 7,100 ft. on its test at Iniskin Bay across the Cook Inlet from Kenai Peninsula.

... **Kenai Peninsula.** Union Oil Co. and Ohio Oil Co. were drilling below 7,200 ft. on a test located on a 61,468-acre unit. The unit, located south of the Swanson River Unit, has been officially designated the Kenai Unit.

Wildcat pair drills in New Mexico

A PAIR OF WILDCATS is drilling in New Mexico's barren Lucero basin. One is in Socorro County, the other in Valencia.

A. N. Spanel and W. O. Heinze 1-F Santa Fe was drilling below 700 ft. in Socorro County. Location is SE NW 17-4n-5w. The Valencia County wildcat is Spanel-Heinze 1-M Santa Fe. It is in SW SW 5-5n-7w.

Location was staked for the 1-H Santa Fe in Catron County in SE NE 27-4n-11w. All three of these wildcats are slated to Precambrian.

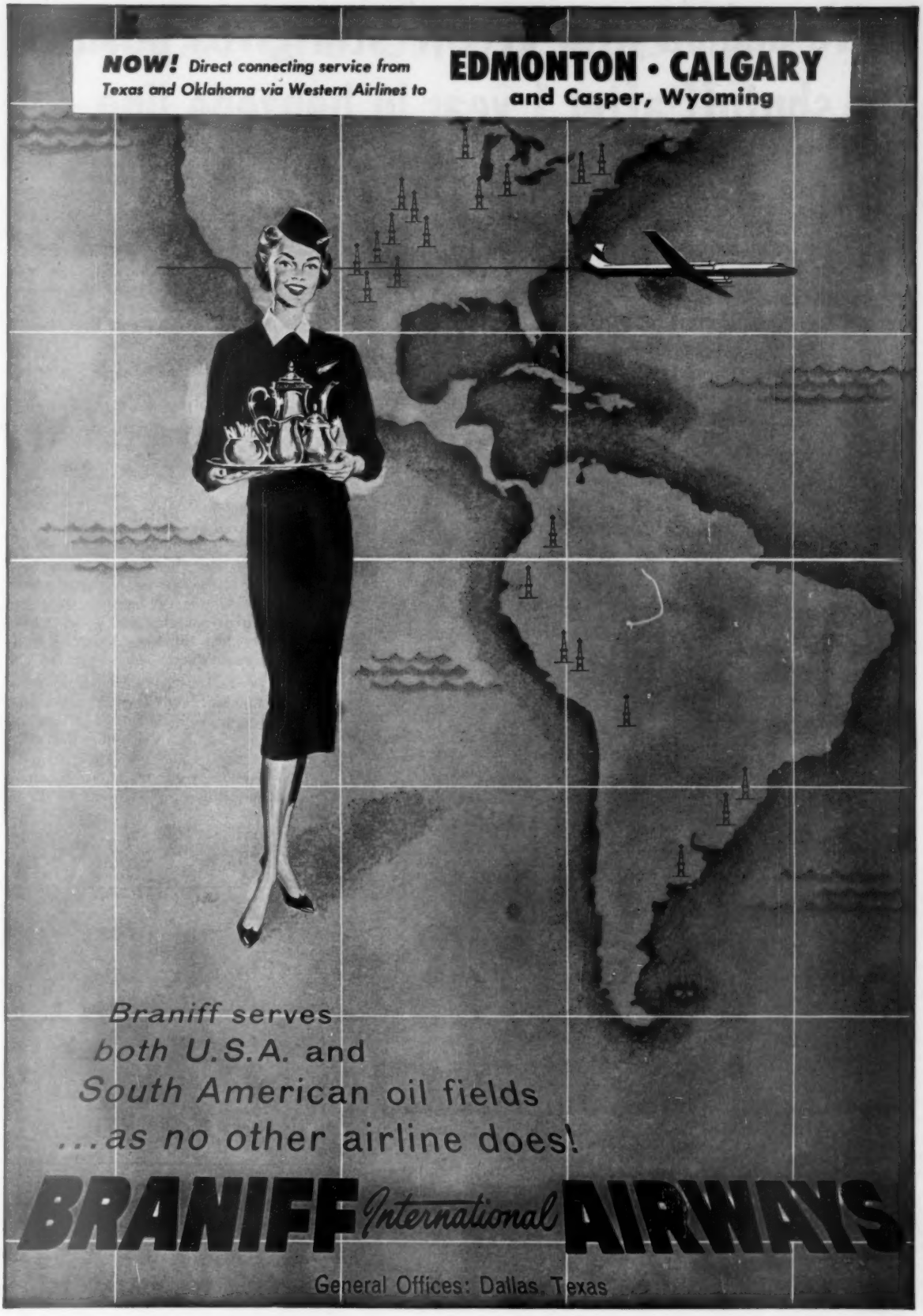
Pemex drills near Humble's dry hole

REPORTS from Deming, N. M., state that a wildcat is being drilled just across the border in Mexico by Petroleos Mexicanos. Location is near the village of Guzman in the State of Chihuahua. This puts the wildcat about 30 miles southeast of Humble Oil & Refining Co.'s Hidalgo County dry hole in New Mexico. The well went to 14,585 ft.

Otero jumps southeast

Northwest New Mexico's big Otero trend appears to have a major southeastern extension.

Northwest Production Corp. completed a confirmation well to the Johnston & Shear Graneros Upper Cretaceous discovery well in Rio Arriba County. The 15-11 S well flowed more than 1,000 bbl. of oil on tests. Daily rate after stabilization was 85.14 bbl. Net pay is 38 ft. thick. Perforations are at 7,215-22, 7,226-52, and 7,284-89 ft.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Valve sealed with VITON® still gives positive shutoff after 1 year in benzene line

VITON synthetic rubber doesn't swell in the presence of benzene. In these valves at Richfield Oil Company, it has performed well for over a year. Cutaway photo of the valve, right, shows how VITON is used as O-ring and primary seat material.

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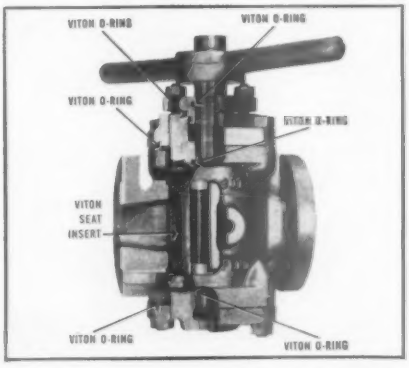

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Oil picture bright in B.C.

SPARKED by proposed pipelines, British Columbia's major oil-field regions are undoubtedly in for a great deal of development drilling during the next year. It is understood that one group has already made its intentions known and plans to drill up to 35 wells in Boundary Lake field alone. Other fields in this general sector of the northeastern portion of the province include Milligan Creek and Beatton River. In addition, there have been a few strikes in the region which have as yet been undeveloped and are only single-well successes.

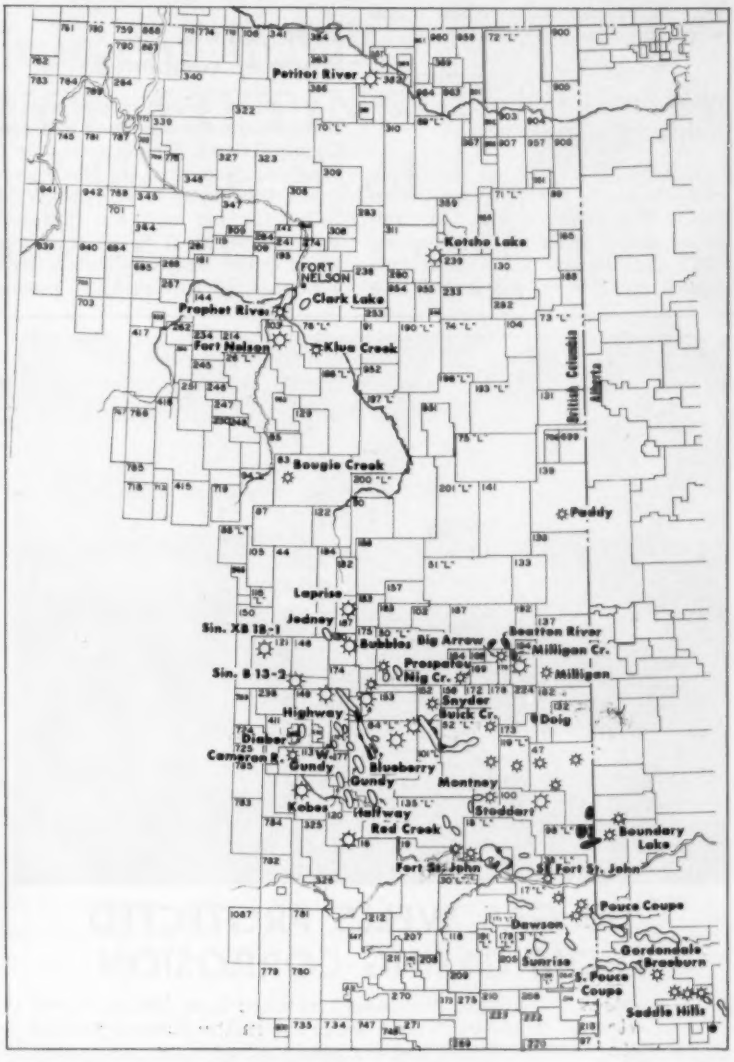
The group behind the large-scale drilling program is headed by Imperial Oil, Ltd., and includes Pacific Petroleums, Ltd., Canada Southern Petroleum. Ltd., United Canso Oils, Ltd., and the Catawba Corp.

Reserves . . . The importance of the area's potential as an oil-producing region is underlined by the estimated crude-oil reserves. Consultants for one of the companies presently applying for a permit to construct a line from the fields in question have estimated that the aggregate total proven remaining and probable additional oil reserves are about 155,078,000 bbl.

Three separate firms vying for the right to construct the line include Peace River Oil Pipe Line (B. C.), Ltd.; Trans Prairie Pipeline, Ltd., and Gibson Petroleum Co. The first company's proposal schedules a line from the Boundary Lake and Milligan Creek-Beatton River areas to link to a refinery at Dawson Creek and eventually tie in with the existing Peace River Oil Pipe Line (the parent company) from Sturgeon Lake oil field in Alberta to the Trans Mountain system at Edson, Alta. The other two companies both propose lines from the oil fields to the Dawson Creek refinery.

By far the largest of the three schemes is the Peace River proposal. The line will feature an ultimate capacity of 25,200 bbl. per day but would have an initial capacity of about 11,500 bbl. daily. Included will be 13 miles of gathering lines and related pumping units, while the line itself will be 113 miles long and require one main-line pump station. Estimate cost of construction of this line is $8,600,000 and if it is successful in gaining the permit, it would start construction immediately with its completion date set for the end of October.

Peace River is owned by 32 oil-producing companies owning large production leases in northeastern British Columbia, Alberta and other provinces. The main shareholders are: Amerada Petroleum Corp.; British American Oil Co., Ltd.; Canadian Husky Oil, Ltd.; Hudson's Bay Oil & Gas Co., Ltd.; Imperial Oil, Ltd.; Shell Oil Co. of Canada, Ltd.; Texaco Exploration Co.; Union Oil Co. of California; and Western Leaseholds, Ltd.



Northeastern British Columbia is building up to its highest exploratory pitch yet. Gas is still the prime target in this western Canada province. The recent major gas discovery at Petitot River further enhances this area's future as a tremendous gas province. There is evidence of major reefing in the area which covers about 250 square miles. The Petitot River discovery rivals Berland River with its absolute open-flow potential of more than 150 M.M.c.f.d. (base map from annual report, Canada Southern Petroleum, Ltd.).

At the proposed drilling program at Boundary Lake, Imperial in conjunction with Pacific Petroleums, Ltd., has carried out small-scale exploratory and development work previously on the lands which were farmed out to it by the Canada Southern group. The 35 wells, therefore, will be drilled with the view of developing the exploratory successes.

What activity will be carried out in the Beatton River and Milligan Creek

fields is still a question mark but Triad Oil Co. in the case of Beatton and the Hudson's Bay-Union of California team at Milligan Creek will undoubtedly swing even more rigs to work in their respective regions if and when a pipeline is approved.

New pool tested at Kentucky's Lawrence

In Lawrence County on Right Fork of Little Blaine Creek, 21-S-81, Kentucky West Virginia Gas Co. continues testing at its new pool opener 1115 Zeal Hayes. Corniferous lime topped at 1,986 ft. was drilled to a total depth of 2,204 ft. with oil reported at 2,143 ft. Currently well is testing 50-60 bbl. daily of sour crude, swabbing and flowing through tubing.

Deep Illinois Producer completed

One of the deepest producers in the Illinois basin was completed in Wayne County, Illinois, 6 miles southwest of Fairfield. It is the H. H. Weinert Estate 5-B Morlan in SE NE NW 33-2s-7e. The old well was drilled in 1942 to 3,336 ft. with production found in the McClosky lime. Later it went to 4,148 ft. with Salem production. In June production was established in the Osage at 4,137-48 ft. The well made 195 bbl. per day through choke, flowing naturally.

Illinois' deepest producer is the Kingwood 24A Shanafelt in Marion County. This Trenton well got oil at 4,657 ft. and was completed in 1943. Location is 20-2n-2e.

Bulletin published on Illinois' Freeburg pool

A bulletin on the Freeburg Gas Pool, St. Clair County, Illinois, by Wayne F. Meents, has been published by the Illinois State Geological Survey.

The Freeburg gas pool, discovered in 1956, is near the western border of southern Illinois and at the west edge of the main oil and gas-producing region. Twenty-nine gas wells in the pool in an area of 2,400 acres had initial open-flow capacities ranging from 139,000 to nearly 4 M.M. c.f.d. from Cypress Sandstone. Average depth to the top of the gas pay is 335 ft. At present the wells are shut in, but the contract for a pipeline has been let and gas should be marketed in the East St. Louis area by the winter of 1959.

The Freeburg gas reservoir and its underlying formations may be important for the underground storage of natural gas brought from other areas. Because of the economic importance of the gas reservoir, the geology and production history of the area are summarized here.

Mississippian producer completed in Kentucky

On Wright Fork of Boone Fork of Kentucky River in Letcher County, Kentucky West Virginia Gas Co., have completed 6474 John W. Wright as a Mississippian Big Lime producer. Well topped Big Lime at 2,897 ft., had pay at 2,939 ft. and was completed at a total depth of 2,959 ft. for 268 M.c.f.d. of gas.

New pool confirmed in Ohio's Muskingum County

In Ohio, a second producer confirms the new pool discovery in southwest Highland township, Muskingum County.

Kewanee Oil Co. 1 George Dunn, Section 25, gaged 20 bbl. oil and 400 M.c.f. with rock pressure of 1,200 psi. after fracture. The Clinton was logged at 4,370-4,441 ft. with natural production of 520 M.c.f.

A third location is now drilling in the area.

200 GAS WELLS PROTECTED FROM CASING CORROSION

Problem. To protect the casing in more than 200 gas wells from external corrosion. These wells are in the Kansas section of the Hugoton gas field, and are operated by four companies. Six of the wells are in the sand hills area where soil resistivities are of the order of 20,000 ohm-cms.

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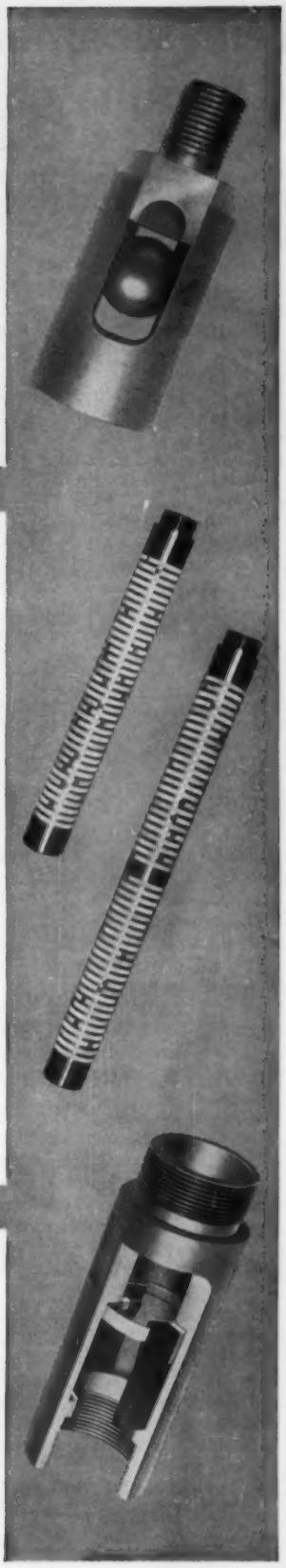

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Mild weather brings California gas hunt

BY BILL SMITH

CALIFORNIA'S northern valley region is in the midst of a heated gas search this summer.

THE ADVENT of summer weather has touched off a major spurt in wildcatting for gas in North Central California counties.

Current drilling operations are at a level above that normally experienced this time of year in the gas play. Playing a major role in the increased activity is the economics of gas versus oil in California at the present time.

Operators can pretty well count on being able to market any gas production developed, while no such promise is held for any oil turned up these days. In addition, drilling for gas is not as expensive, on an average, as oil prospecting. The reason for this is largely because wildcatting for oil involves deep drilling in California these days as most all the shallow prospects have been looked at.

A current rundown on where the gas searchers are drilling in California shows these projects:

Glenn County . . . This northern gas county is one of the most active, with seven tests drilling or planned.

. . . Afton. General Exploration Co. was drilling below 6,366 ft. on an F-Zone wildcat located about 1 mile southeast of the nearest Afton gas-field producer.

. . . Bee Hive Bend. W. S. Payne, Jr., and associates were rigging a rotary to deepen a 6,000-ft. gas test completed originally in 1954 in the center of the Beehive Bend gas field. Plans call for a new total depth of around 6,300 ft. Redrilling will start at around the 5,500-ft. level where the hole was plugged for the earlier completion.

General Petroleum Corp. just recompleted an original shallow zone well in a deeper zone at a rate of 13,900 M.c.f.d. through a 1-in. choke. This well, 81 Unit, was recompleted in a selectivity perforated zone between 5,483 and 6,334 ft. Originally it was completed at around 3,600 ft. in 1955. Drill site is in SE NW 10-19n-2w which also is virtually in the center of the Beehive Bend field.

Three operators were readying other tests for the field. Bradley Muhl and associates planned a 5,000-ft. extension test on the southeast edge of the field. R. W. McBurney was waiting on a rig for a wildcat staked about 1 mile west of the north end of the field. Ben J. Taylor announced plans for a 5,500-ft. well near the south central part of the field.

. . . Perkins Lake. Kenneth Sperry was drilling below 100 ft. on a wildcat 2½ miles northwest of the small Perkins Lake gas field in adjoining Butte County. The drill site is about 1 mile west of the Sacramento River which separates the Beehive Bend and Perkins Lake-Llano Seco gas fields.

Colusa County . . . Two wildcats are underway in this county just to the south of Glenn County. They are:

. . . Arbuckle. Trico Oil and Gas Co. was drilling below 6,758 ft. on 1 Zumwalt about 5 miles northeast of the town of Arbuckle and about 6 miles in the same direction from the nearest Arbuckle gas-field well.

. . . Wild Goose. Artnell Co. was cementing casing to 514 ft. in a wildcat being drilled about 2 miles northwest of the nearest producer in the Wild Goose field.

Sacramento County . . . Activity in this county, which is the hub of the gas-rich Sacramento Valley counties, was limited to two areas. They were:

. . . Walnut Grove. Brazos Oil and Gas Co. was drilling below 8,362 ft. on a wildcat located in the Walnut Grove area a couple miles due west of the Thornton gas field.

. . . River Island. Both Brazos Oil and E. C. Brown, operator, recently announced plans for wells in this big gas field. The Brazos test is slated for 10,000 ft. and will be drilled in the center of the field. The Brown test is labeled an extension try with a location staked on the southeast flank of the field.

Solano County . . . Gas searchers were very active in this Central California gas county in the Sacramento Valley region. A census showed seven projects either on tap or drilling.

. . . Kirby Hills. G. E. Kadane and Sons staked a location for a 6,500-ft. wildcat about 1 mile south of the nearest Kirby Hills gas-field producer.

. . . Maine Prairie. Arcady Oil Co. was drilling below 4,678 ft. on an extension test on the southeast flank of this field.

In addition, Union Oil Co. of California revealed plans to drill two wildcats soon, associated with the Maine Prairie field. One will be drilled 4½ miles northwest of the field and the other 2½-miles southeast of the field.

About midway between the main part of the Maine Prairie field and the Millar area, Intex Oil Co. was drilling below 4,600 ft. on a wildcat.

. . . Suisun Bay. Big news in this region of Solano County was the efforts of G. E. Kadane and Sons to shut off a blowout in a wildcat in the Suisun Bay region. The operator was drilling below 500 ft. on an offset relief well to the blowout which has been blowing for more than a month. The blowout, 10 Suisun Community, was at 1,024 ft. when the mishap occurred.

San Joaquin County . . . San Joaquin County, the southernmost gas county in the Sacramento Valley region, was also one of the most active.

. . . Roberts Island. Atlantic Oil Co. was drilling below 4,725 ft. on a wildcat located a little more than 1 mile southeast of the nearest Roberts Island producer.

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- extremely versatile . . . may be reset at point of installation . . . may be adapted to safeguard almost any type or kind of equipment.

. . . write for free brochure

CALIFORNIA CONTROLS COMPANY
1525 Powell St., Oakland 8, California

... **Vernalis.** This field, which has been the pace setter in drilling activity for California gas fields the past year, was picking up again after a lull of several months.

Porter Sesnon-Great Basins Petroleum Co. was drilling below 3,850 ft. on a development at Vernalis and Standard Oil Co. of California was drilling below 962 ft. on the other active project in the field.

Also, the Sesnon-Great Basins interests had another development well site staked for immediate drilling.

... **McDonald Island.** Natural Gas Corp. of California revealed plans for an extension test ½-mile south of the nearest field producer. No spud date was revealed.

... **River Island.** E. C. Brown, operator, was rigging a rotary for a wildcat on the extreme southeast edge of the field just over the Sacramento-San Joaquin County lines in San Joaquin County.

Contra Costa County . . . Site for an extension test and a rework of an earlier discovery held the spotlight here:

... **Los Medanos.** McCulloch Oil Exploration Co. of California, Inc., was reperforating a shallow interval in the Los Medanos gas field discovery well drilled more than a year ago. The discovery interval was at 1,872-1,908 ft. while the new interval being tested was at 1,665-1,708 ft.

... **Willow Pass.** Trico Oil & Gas Co. was moving in a rig to drill the first followup to the Willow Pass field discovery well completed late last May. This will be a northwest offset. This area is about 2 miles east of Los Medanos gas field.

Tehama County . . . This northernmost gas county in California was slated to see a two-well program get underway soon in the Corning gas field area by Buttes Gas & Oil Co. Drilling will be in the South Dome area of the field.

Wildcatters move to back country

Production prospects in some of California's more remote areas were attracting increasing interest.

Among the leaders in this rank wildcatting is Humble Oil & Refining Co. with three tests underway or planned for regions away from any production. A brief rundown on the Humble tests showed:

... **Pescadero.** Humble staked a site for a stratigraphic test for this remote San Mateo County area. The nearest well is Union Oil Co.'s Oil Creek field discovery well a couple miles to the west. The general area is in the Santa Cruz mountains on the coast of Central California.

... **San Clemente.** Humble just completed a 1,040-ft. core hole on a site 4 miles east of San Juan Capistrano and was drilling ahead on another several miles south of the first hole. The general area is near a subcommercial discovery made several years ago by Texaco.

Another interesting wildcat underway, and which ranks as the wildest in the state at the moment, is being drilled by DeAnza Oil Co., Ltd., in Imperial County only 3½ miles north of the Mexican border. It was drilling below 200 ft. with a projected total depth of 1,000 ft. Nearest production

EVER WONDER ??

GEOQUESTION . . .

Where did the Reklaw formation of South Texas get its name?

GEOANSWER . . .

It's Walker spelled backwards. Actually, the formation is named for the town of Reklaw in Cherokee County.

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$175 TO $500 PROTECTS WELL CASINGS IN HUGOTON FIELD

Galvomag magnesium anodes can prevent corrosion in gas well casings for a decade or more . . . without an external power source.

In 1954, a survey of the 6,000 odd wells in the Hugoton Gas Field revealed 56 leaks. Since most of the wells were comparatively new (two-thirds were less than five years old), this was a serious problem. Projecting the rate of leak increase showed there would be over 300 leaks by 1960.

The cost of repairing these production wasting leaks usually ran between $10,000 and $40,000, using liners or the cement squeeze method. Several Hugoton producers decided to take immediate preventative action. After extensive field tests were made, it appeared that sulfate-reducing bacteria was the villain. These microorganisms convert the sulfates into hydrogen sulphide, which in turn attacks the casings. A Dow mag-

nesium anode distributor was asked to make an analysis of the situation and recommend a practical solution.

In determining the most practical type of corrosion protection, two factors had to be considered. First, the wells were situated a mile apart and few electric power lines were available. This meant a considerable expense if cathodic equipment requiring a power source were used. Second, to what depth would protection be possible? In some soil conditions, cathodic protection cannot be used at all. In the Williston Basin, for example, a massive layer of salt above the corroding formation blocks electrical currents from reaching this portion of the casing. Fortunately, the Hugoton field was free and clear of such obstructions.

By running potential-drop tests in casings throughout the field, it was found that a current of from 0.5 to 2.5 amperes would provide ample protection to total depth. The installation of Galvomag® magnesium anodes was recommended as the best solution, from the standpoint of economy, as well as ease of installation. Also, as magnesium anodes do not set up "stray" currents in the soil, there was no danger of interference with foreign structures.

MAGNESIUM ANODES in a wide range of sizes and shapes provide flexibility to allow the most efficient design in many different types of installations. Galvomag anodes (shown above) have 25% more throwing power than ordinary magnesium anodes . . . are used extensively in the Hugoton Field.

DOW DISTRIBUTORS provide experienced technical services on corrosion problems. Field tests of soil conditions and analyses of the requirements of individual wells can result in substantial savings in installation and anode costs.

Three to eighteen anodes were used per well, at a total cost of from $150 to $500 per installation. A maximum of seven were used in each bed, about 85-100 feet away from the casing. Each well was examined individually to determine the most efficient installation. Factors such as variation in soil resistance, well-to-earth resistance and potential, and current requirements were taken into full account in selecting the number and arrangement of anodes to be used for each well. The installations were designed for a ten year life but they may last 15 to 18 years because of polarization of the well casings.

Since 1954, over 800 wells in the Hugoton Gas Field have been cathodically protected with magnesium anodes. Casing leaks due to external corrosion are no longer a problem on these wells.

The Dow magnesium anode distributors listed below are ready to help you get the most for your corrosion protection dollar. Contact one of them next time you have a corrosion problem involving well casings, pipelines, storage tanks or other equipment.

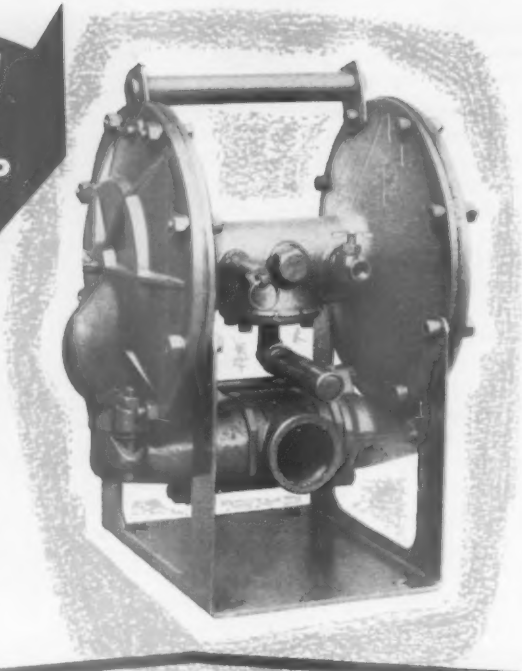
CALL THE DISTRIBUTOR NEAREST YOU:

CATHODIC PROTECTION SERVICE, Houston, Texas
CORROSION SERVICES, INC., Tulsa, Oklahoma
ELECTRO RUST-PROOFING CORP. (Service Division), Belleville, N. J.
ETS-HOKIN & GALVAN, San Francisco, Calif.
THE HARCO CORP., Cleveland, Ohio
INTERPROVINCIAL CORROSION CONTROL COMPANY, Burlington, Ontario
ROYSTON LABORATORIES, INC., Blawnox, Penna.
STUART STEEL PROTECTION CORP., Plainfield, N. J.
THE VANODE CO., Pasadena, Calif.

THE DOW CHEMICAL COMPANY · MIDLAND, MICHIGAN

NEW TEXSTEAM SERIES 9000 UTILITY PUMP

Ideal for pumping out sumps, ditches—for recycling, transferring and many other services.



This double acting diaphragm pump, powered by air or gas at 5 or more psi, has a discharge pressure of 30 psi and a maximum volume of 45 gpm. It pumps slurries and abrasive fluids without difficulty.

Powering pressure enters through a single chamber connecting the two diaphragms. A reversing valve switches pressure from one diaphragm to the other providing a constant, smooth suction and discharge. There are no lost strokes or motion. As one diaphragm is discharging the other is on the suction stroke.

The TXT Utility Pump has an input to output ratio of approximately 1 to 1. It requires no packing . . . no priming. Diaphragms are available in plastic, Hycar, Neoprene or other materials suitable for the commodity being pumped. The Utility Pump is 16" x 13" x 13" and weighs only 61 lbs. For additional data and complete specifications, write for Bulletin No. UP-100.

TXT TEXSTEAM Corporation

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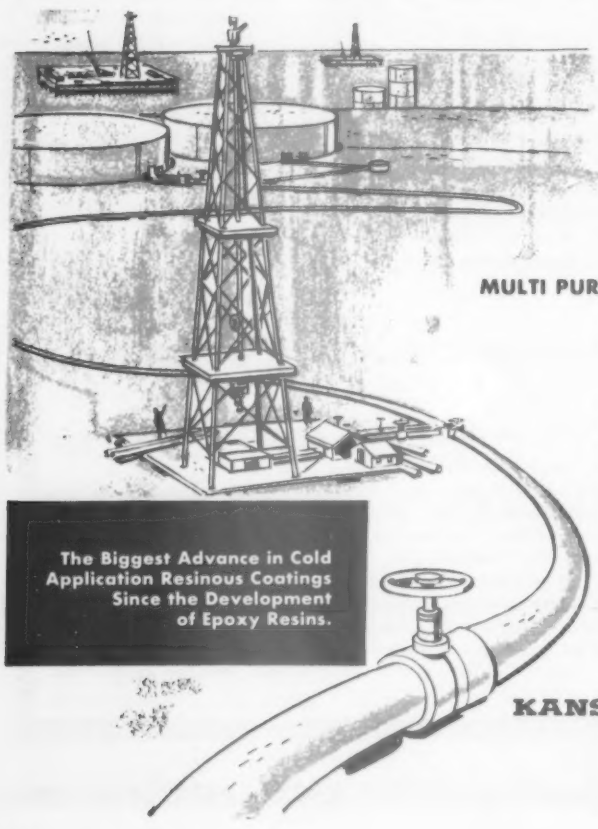

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is more than 150 airline miles north, also at West Newport.

Sooner well hits

OKLAHOMA'S northwestern area added another important producing area. Sinclair Oil & Gas Co. completed the 1 Rohrer, C SE NW 20-29n-22w, Harper County discovery, flowed 18 bbl. of condensate in 12 hours and 7,592 M.c.f.d. from Morrow Pennsylvanian perforations at 5,701-11 ft.

This new discovery is 9½ miles north of the town of Buffalo and 2½ miles north of North Buffalo field, a multipay producing area.

Panhandle stays active

The inside-Hugoton-field deep-production story continues to highlight Texas County activity in the Oklahoma Panhandle.

The most active area currently is in the southeastern part of the county where Phillips Petroleum Co. opened production 2 years ago at 2 Pearl. That well flowed 11,992 M.c.f.d. from Oswego Pennsylvanian at 5,760-72 ft. Location of this good well is NW NW 16-1n-15eCM. Later the 2 Wavia in SW NE 17-1n-15eCM, Texas County, confirmed this production and opened a new pay sand as well. Calculated absolute open flow was 62,213 M.c.f.d. from Oswego; from Cherokee it flowed 29,230 M.c.f.d. This year Morrow Pennsylvanian production was opened at 2 Atar in C NW SE 9-1n-5eCM. This well flowed 2,869 M.c.f.d. from the "G" sand at 6,842-79 ft. Another well, the 2 Curt in SW NE 19-1n-15eCM made 3,254 M.c.f.d. from Cherokee.

East of this area there is a possible linkup between North Hardesty and Camrick fields. Panhandle Eastern Pipeline Co. 1-5 Osgood, NW NW SE 5-2n-18eCM, flowed 8,378 M.c.f.d. from Morrow sand. Location puts it 2 miles south of North Hardesty field Morrow production and 3 miles west of Morrow gas production in Camrick itself.

Drillers tag Cimarron

Southeastern Cimarron County in the Oklahoma Panhandle's far-western reaches is in the midst of its busiest drilling campaign since the days of Keyes gas field.

Important new finds in this area include Graham-Michaelis Drilling Co. 1 Fleming, an indicated Oswego and Topeka Pennsylvanian gas extension discovery in C NW SE 2-1n-9eCM, 14 miles southeast of Keyes. The well flowed up to 3,400 M.c.f.d. Nearest Oswego gas is 2 miles south at Southeast Griggs field. Oswego was at 4,326-36 ft.

From Topeka the well made up to 2,080 M.c.f.d. at 3,426-30 and 3,440-44 ft. This Topeka production extends the gas pay 3½ miles north from the Southeast Griggs field.

Discovery wells

KANSAS

Meade County: Shamrock Oil & Gas Corp. 1 Boyer, NW NW SE 5-33s-28w. IPF 85 BDPD, 101 M.M.c.f.d., Morrow sand 5,544-5,600 ft. TD 5,650 ft. Gas-condensate discovery of North Borchers field in Dodge City basin.

Sedgwick County: Ernst Development Co. 1 Miller, SW SW NE 33-25s-2e. IPP 180 BOPD, Burgess sand 2,917-21 ft., 38°. TD 2,927 ft. Discovery well of South Ulmer field in South-Central Kansas basin.

MICHIGAN

Missaukee County: Leonard Oil Inc. 1 Laarman, NE NE SW 19-21n-7w, Riverside Township, west edge Riverside gas storage field. NIP 52 bbl., acid IP 105 bbl. Elevation 1,253 ft., Traverse lime 3,332 ft., Dundee 3,969 ft., oil pay 3,971-74 ft. TD 3,974 ft. (New oil pool).

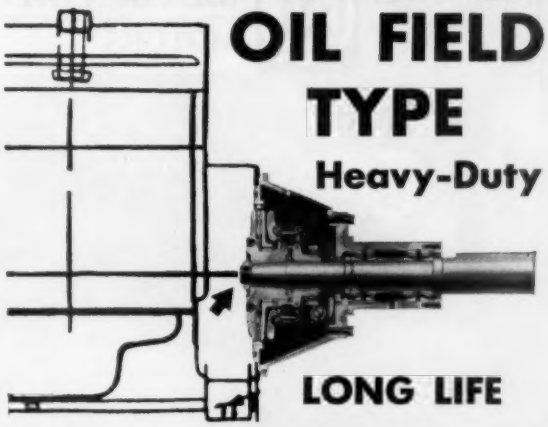
Allegan County: Muskegon Development Co. 1 Confer, SW NE NE 1-3n-14w. NIP show oil, pump 29 BOPD after acid and frac. Elevation 652, Salina E zone 2,389 ft., pay 2,389-2,400. TD 2,410 ft. (New pay in Diamond Springs pool).

Wasetenaw County: William Albers 1 Schoonover, NE SW SE 6-1s-3e, Lyn-

ROCKFORD

OIL FIELD TYPE

Heavy-Duty



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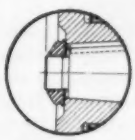
POWER TAKE-OFF

➡ Eliminates the Pilot Bearing

Eighty five percent of all take-off failures that are caused by misalignment, lack of lubrication, overload and other reasons—stem from the pilot bearing.



By eliminating the pilot bearing—in this new Oil Field type, long-life, extra heavy-duty power take-off—ROCKFORD has reduced down-time to a minimum. This improvement will help increase the trouble-free work-hours of your equipment.

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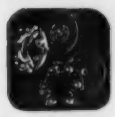
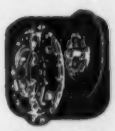
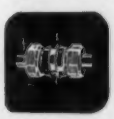


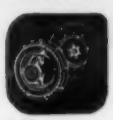
Small Spring Loaded



Heavy Duty Spring Loaded



Oil or Dry Multiple Disc



Heavy Duty Over Center

Power Take-Offs

Speed Reducers

CLUTCHES

don Township, gage 1,600 M.c.f. of gas. Elevation 936, Traverse 1,294, gas pay 1,298-1,302; Detroit River 1,734," gas pay 1,734-1,815 ft. TD 1,815 ft. (New pay in Chelsea gas pool).

NEBRASKA

Banner County: British-American Oil Producing Co. 1 Olson "D," C NE SE 8-17n-53w. IPP 84 BOPD, "J" sand discovery, new field. TD 5,687 ft. "J" sand.

Midwest Oil Co. et al. 1 Cross, C NE NE 4-18n-57w. IPP 125 BOPD, "J" sand discovery, new field. TD 6,695 ft. Skull Creek.

NORTHWEST NEW MEXICO

San Juan County: Sunray Mid-Continent Oil Co. 1 New Mexico-Federal "K," SW NE NE 6-29n-14w. IPF 845 M.c.f.d., ¾-in. choke, Dakota discovery, new field. TD 5,680 ft. Morrison.

NORTH DAKOTA

Burke County: J. R. Padon et al. 1 Ruppert, C NW SW 34-164n-92w. IP 319 BOPD, Nesson discovery, new field. TD 5,948 ft. Nesson.

EAST TEXAS

Harrison County: Lodi Drilling & Service Co. and John C. Robbins 1 Beasley-Brown Unit, T. A. Pammell Sur., 5½ miles northeast of Blocker. IP 124 BOPD, 13/64-in. choke, TP 700 psi., GOR 3,000:1, 41.9°, Pettet-Page sand 6,432-39 ft. TD 6,623 ft., elevation 391 ft. Discovery of Beasley field.

NORTH TEXAS

Archer County: Akin & Dimmock 4 Will Sternadel, Sec. 36, Blk. 3, Clark & Plumb Subd., 2 mi. Southwest of Scotland. IP 406 BOPD, 24/64-in. choke, TP 250 psi., 44°, GOR 450:1, Mississippian 5,503 ft. TD 5,602 ft. New pay.

Grayson County: Texaco, Inc. 1 Frank Wright Unit, Sam A. Long Sur., A-708, 6 mi. Southwest of Pottsboro. IP 390 BOPD, 14/64-in. choke, TP 875 psi., 34°, GOR 828:1, paw 8,499-8,542 ft. TD 9,500 ft., elevation 695 ft. New pay in Big Mineral, Southeast field.

TEXAS PANHANDLE

Ochiltree County: Shamrock Oil & Gas Corp. 1 J. V. Stump et ux, Section 15, Blk. JT, TWNG Sur., 6 miles south of Farnsworth. IPF 18.37 BOPD, 3/16-in., 37.5°, lower Missouri 6,578-6,622 ft. TD 8,597 ft.

Hansford County: Amarillo Oil Co. 1 John Venneman, Section 6, Blk. 46, W. G. Railey Survey, 12 miles northeast of Gruver, 1½ miles northwest of East Bernstein Lansing-Kansas City field, 1¼ miles southeast of Hitchland field. Northeast part of county. IPCAOF: 9,600 M.c.f.d., Atoka 6,420-30 ft., TD 7,379 ft. Gas discovery in Anadarko basin.

WEST CENTRAL TEXAS

Comanche County: Allstate Oil & Gas, Inc. 5 Bauer, Jas. Madison Sur. 40, 2½ miles west of Sidney. IP 1,850 M.c.f. of gas, Marble Falls 2,177-2-280 ft. TD 2,300 ft. Shut in.

Jones County: Fletcher Oil & Gas Drilling Corp. 1 Horton, DeWitt CSL Sur. 150, 7 miles northwest of Merkel. IP 86 BOPD, 24/64-in. choke, 43°, GOR 680:1, TP 60 psi., Cisco 3,549-59, 3,569-74 ft. TD 4,897 ft.

Palo Pinto County: E. C. Johnston Co. 1 Nellie Hittson, Sec. 34, Blk. 2, T&P Sur., 5 miles west of Palo Pinto. IP 1,133 M.c.f. of gas, plus 10 BOPD, 38°, conglomerate 3,995-4,001 ft. TD 4,050 ft.

Texoma Production Co. 1 Stephens, Sec. 88, Blk. 3, T&P Sur., 3 miles north of Strawn. IP 3,120 M.c.f. of gas, pay 3,462-72 ft. TD 3,715 ft.

Parker County: Beacon Oil & Refining Co. 1 Frank Veith, Sec. 239, T&P Sur., A-1487, 3 miles west of Poolville. IP 106 BOPD, 16/64-in. choke, 45°, GOR 2426:1, TP 300 psi., Strawn 2,892-2,901 ft. TD 4,374 ft.

Frank M. Farley 1 Springfield Oil Unit 1, Sec. 47, T&P Sur., 16 miles northeast of Weatherford. IPP 1 BOPD, 38°, Strawn 2,810-30 ft. TD 2,916 ft.

Shackelford County: H. F. Pettigrew 1 Newell, Sec. 1, Blk. 12, T&P Sur., 5 miles west of Albany. IPP 7 BOPD, 36°, Lower Tannehill 1,202-10 ft. TD 1,285 ft.

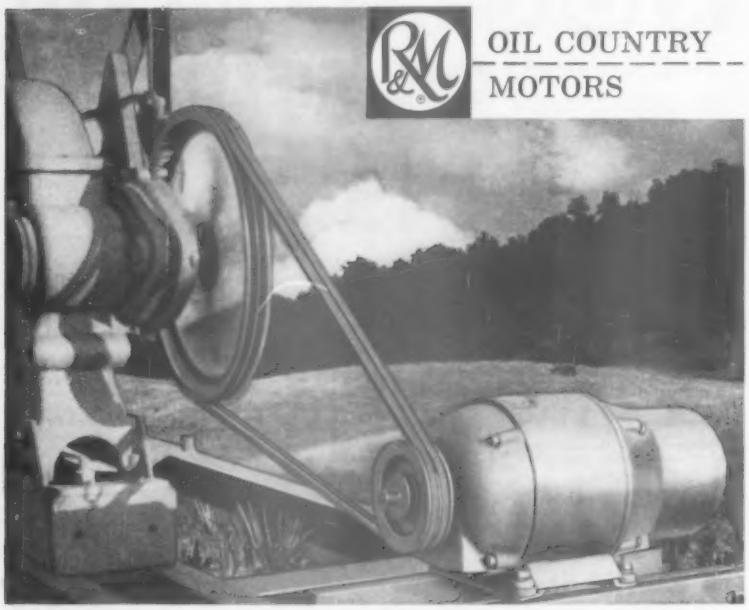
Taylor County: Bridwell Oil Co. 1 Camp, Sec. 49, Blk. 1, SPRR Sur., 2 miles east of Buffalo Gap. IPP 35 BOPD, 39°, GOR 290:1, Flippen sand 2,333 ft. TD 2,337 ft.

Sojourner Drilling Corp. et al. 1 A. M. Hinds, John McSherry Sur., 2 miles southwest of Tye. IP 106 BOPD, 14/64-in. choke, 40°, GOR 972:1, TP 555 psi., Fry sand 4,257-67 ft. TD 4,415 ft.

Throckmorton County: Humble Oil & Refining Co. 9 Watt R. Matthews, Sec. 3, AB&M Sur., 14 miles southwest of Throckmorton. IP 689 M.c.f. of gas, TD 1,600 ft.

WYOMING

Crook County: Petroleum, Inc. et al. 1 Michael Cordell, C SE NW 8-51n-68w. IPP 231 BOPD, cut 12% water, Dakota discovery, new field. TD 6,102 ft. Morrison.



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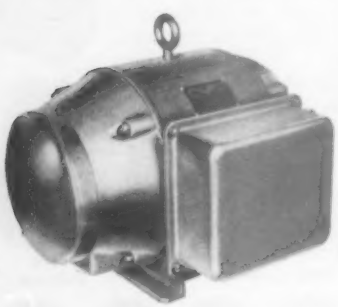
New Robbins & Myers
Single Phase *"All Weather 40" Oil Country Motors*



Ratings up to 20 HP, eliminate maintenance and constant attention when they replace internal combustion engines in remote areas. Motors are fully weatherized against moisture, dirt, heat. Auxiliary mechanism is externally mounted for simple inspection, even while motor is running. For reduced current starting, sizes above 7½ HP (10, 15, 20 HP) have unique *"cushion start"* system available as extra-cost option. Write for Bulletin 470-OG

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MOTOR DIVISION • SPRINGFIELD, OHIO

Geology Won Over Engineering

. . . for George Galloway who got a late start but still rose to Pan Am's top exploration job in only 20 years.

FOR A MAN who originally had trouble choosing between civil engineering and geology, George H. Galloway has done right well with geology.

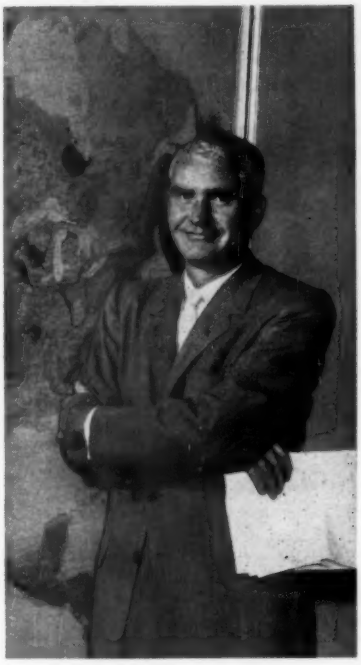
Galloway last month reached the high point of his 20-year geological career. He took over the job of vice president and director in charge of exploration for Pan American Petroleum Corp.

Galloway's route to a top executive position has been unusually short. It began 43 years ago in Palmyra, Neb. But shortly after his birth, the Galloway family moved to Lincoln, where Galloway's father operated an auto agency.

When young George was about 10, he began his regular Saturday job of washing and polishing the row of Chrysler "70's," Auburns, Moons, and Marmons on his father's used-car lot.

At school, young George was a good student. In Lincoln High, his grades continued excellent, although Galloway devoted more time to athletics, earning letters in track and football.

In 1935, Galloway entered the University of Nebraska. He had a deep interest in both geology and civil engineering, but he couldn't decide between them. So in 1939, he was awarded a B.S. degree in civil engineering, with a major in geology.



George H. Galloway
. . . new Pan American vice president.

Fancy for drilling . . . After graduation, Galloway took a job with the Nebraska Highway Department.

But one day when a Pan American core-drill crew began work near Falls City, Galloway changed his mind. He applied for work and was hired as a surveyor for the crew.

In one sense, George Galloway and Pan American have grown up together. The oil firm (then Stanolind Oil & Gas) had been operating only 8 years and was in the midst of an intensive exploration campaign. Galloway fit perfectly into the new firm with its expanding activities.

Although Galloway's principal assignments during the next 20 years were limited to six, his assigned locations shifted considerably. As a surveyor and then a geologist, he worked in Nebraska, Texas, Oklahoma, and Kansas during his first 3 years of employment.

In 1943, Galloway was appointed senior geologist at Tulsa; 2 years later he was district geologist at Oklahoma City; and in another 3 years he was division geologist at Oklahoma City.

In January 1952, Galloway won promotion to assistant chief geologist in charge of programs and was assigned to Tulsa.

After more than 22 moves in 13 years, the Galloways felt at last they were in a position to buy a house and settle.

They bought the house.

But 3 months later, they were en route to Calgary, Alta., where Galloway was appointed Canadian division manager of Pan Am. Mrs. Galloway (Sandy), once again had packed the household goods. She, George, and the four children had another new home.

In Canada, Galloway found his greatest professional challenge—and Sandy and the children found their first really permanent home.

Success in Canada . . . During Galloway's 7-year tenure as division manager, Pan Am's Canadian division grew spectacularly.

At Pembina—in 1952 a field just being developed—Pan Am took a leading role. Today, the firm is one of the largest Pembina producers holding 25% of the field's production.

As exploration activities expanded under Galloway's guidance, Pan Am employes increased from about 50 in 1952 to nearly 500 in 1959. Exploration fanned out into western and northern Alberta, jumped overland to northern British Columbia. Early this year Pan Am created a new Canadian district comprising the State of Alaska.

Pan Am crews explored areas near the Arctic Ocean in northern Yukon last summer. An aerial magnetometer crew was carrying out work in one of the largest single tracts ever purchased by an oil company in Canada—the 12½-million-acre block of the Stikine River basin in central-western British Columbia.

At the same time, drilling crews scored important finds in many other areas in Alberta. In West Whitecourt area of northwestern Alberta, Pan Am opened a major new find in the Devonian D-3 reef. Later, the firm discovered the potentially excellent Saddle Hills area, also in western Alberta.

Currently, Pan Am is completing a 19-well drilling program in its Swan Hill block with extremely good results. These include a well which at about 2,500 bbl. a day potential is one of Canada's best finds.

This month, George Galloway moved his family back to Tulsa. The Galloway children—Mike, 16, Betsy, 14, Mark, 10, and Tracy, 7—are discussing with great interest what school will be like next fall. Only Mike and Betsy have ever attended any but Canadian schools.

It appears the Galloways may get to stay in Tulsa this time.

●

▶▶▶ Personals

Frederick Stueck was sworn in recently for his second 5-year term as member of the Federal Power Commission.

Basil P. Kantzer, vice president of Union Oil Co. and manager of the Gulf Coast division in Houston, has been named to the advisory committee of Bank of the Southwest's board of directors.

R. J. C. Pringle, crude-oil manager for Shell Oil Co. of Canada, Ltd., has been named manager of transportation and supply in the company's Toronto headquarters. **R. L. Hope** will succeed Pringle.

Personals

M. David Haynes, superintendent of Tidewater Oil Co.'s Delaware City, Del., refinery, has been named assistant manufacturing manager, eastern division. He will be succeeded at the Delaware refinery by **E. L. Raun,** superintendent of crude, cracking,

HAYNES

RAUN

and coking operations there. In other changes in Tidewater's manufacturing division, **Ray Harrison** has been placed on special assignment in petrochemical development; **Lloyd E. Forbes** has been named superintendent of utilities, oil dispatching and sulfur recovery; and **Eric R. Westfield** has been named supervisor of economic development. **Charles H. Bennett** has been named staff assistant to the manufacturing manager.

D. G. Waldon, treasurer of Interprovincial Pipe Line Co., has been named assistant general manager. He will headquarter in Edmonton. Waldon replaces **F. J. Stubbs,** who was recently named assistant to the president.

Thomas D. Lumpkin, vice president of Mene Grande Oil Co., has been appointed coordinator of production for Gulf Oil Corp. He will headquarter in Pittsburgh. **William W. Adams,** treasurer and comptroller of Mene Grande, will succeed Lumpkin as vice president.

Frederick C. Schultz, president and a director of Portland Pipe Line Corp. and Montreal Pipe Line Co., Ltd., has retired. He will be succeeded by **Karl D. Emerson,** vice president and treasurer of Portland Pipe Line. **Franklin W. Abbott,** comptroller and assistant treasurer of Portland, will succeed Emerson as treasurer. Schultz was in the foreign department of Standard Oil Co. (N. J.) for many years. He served as president of Jersey subsidiaries in Boliva and Argentina at one time. He joined the Portland-Montreal pipeline system in 1941 and remained with the companies when Jersey Standard sold its interests in the system in 1946.

W. M. Johnson, assistant to the vice president in Shell Oil Co.'s New Orleans exploration and production area, has retired after 34 years with the company.

H. D. Stanley, formerly with Phillips Petroleum Co. in Bartlesville, Okla., has joined DX Sunray Oil Co. as costs and pricing economist, marketing department. He will headquarter in Tulsa.

Mack Atcheson, chief engineer of El Paso Natural Gas Products Co., has been promoted to assistant operating manager of the company. **Virgil A. (Nick) Johnson,** assistant chief engineer, moves up to chief engineer succeeding Atcheson.

W. A. Mead, superintendent of Continental Oil Co.'s Artesia, N. M., production district, has been promoted to superintendent of production for Conoco's New Mexico division. He will headquarter in Roswell. Mead succeeds **R. L. Adams,** who was recently promoted to manager of the CATC marine region in Houston. Mead has been with Conoco since 1947.

Richard D. Burt, staff assistant at Olin Mathieson Chemical Corp.'s Brandenburg, Ky., petrochemical plant, has been named technical staff assistant at SunOlin Chemical Co.'s North Claymont, Del., urea plant now under construction. **James J. Honan,** Sun Oil Co. foreman, has been named general operating foreman at the SunOlin plant. **Bruce G. Hawthorn,** formerly in the technical service division at Sun's Marcus Hook refinery, has been assigned to SunOlin as technical assistant at the new plant. SunOlin is jointly owned by Sun and Olin Mathieson

Frank Fournier, London, Ont., has been named director of Michigan production operations for Panhandle Eastern Pipe Line Co. Panhandle has opened a land, geology, and production operations office in St. Clair, Mich., with **Jack Phillippe,** formerly Panhandle gas storage and production engineer in Liberal, Kans., as Michigan division manager. **George Straight,** formerly in East Lansing, Mich., moves to St. Clair as division geologist. **Max Paris** will be in charge of drilling and production. **Dick H. Hunter,** formerly with Lion Oil division of Monsanto Chemical Co. in Liberal, will head land operations in Michigan for Panhandle. **Gordon Kiddoo,** formerly of Liberal, will be assistant to the division geologist.

Donald B. Lamont, Los Angeles independent, has been elected vice president and a director of San Jose Petroleum, Inc.

Donovan P. Dugan, vice president and superintendent of Tuscarora Pipe Line Co., Ltd., has been elected president. He succeeds **John W. deGroot,** who has retired.

R. B. Goodwillie, research and development laboratory director at Du Pont's Sabine River works, Orange, Tex., has been transferred to Wilmington, Del., as a product manager in polychemical research and development.

Max Key, plastics production manager of Dow Chemical Co.'s Midland, Mich., division, has been appointed operations vice president of Dow Chemical International, S. A. **A. M. Griswold,** vice president of Dow International, and **E. K. Stilbert,** manager of coatings materials for the Dow plastics department, have been named product group vice presidents for the international company.

SHIELDS

JONES

HAWKINS

Don M. Shields, Sunray Mid-Continent Oil Co.'s manager of crude-oil purchases and sales, has been promoted to general manager of domestic crude-oil purchases and sales, a new position. **Marvin C. Jones,** formerly manager of crude-oil traffic for Mid-Continent Pipe Line Co., a subsidiary, has been named manager of foreign crude-oil purchases and sales. **J. W. Hawkins,** manager of planning and development for Mid-Continent Pipe Line, has been named manager of economics and coordination for Sunray Mid-Continent. Shields, Jones, and Hawkins will serve as members of the company's supply and transportation council. In the domestic crude-oil division, **D. A. Harris,** assistant to the manager of crude-oil purchases and sales, has been named manager of Oklahoma crude-oil purchases and

sales. **W. G. Noble,** assistant to the manager of natural gasoline and LPG sales, has been named manager of general lease sales and purchases. Also, **Don M. Bones,** formerly assistant manager of the lease records department, has been appointed manager of the division order section; and **D. R. Nett,** statistical coordinator, has been named coordinator of the crude-supply coordination section. In the economics and coordination division, **M. E. Warr, Jr.,** formerly planning development engineer, becomes evaluation and computer engineer. **D. W. Von Vleck, Jr.,** administrative assistant for Mid-Continent Pipe Line, has been named procedures and training supervisor; and **V. R. Graham,** planning development clerk, has been named costs and methods analyst.

Paul O. Meadows, Midland, Tex., division petroleum engineer for Honolulu Oil Corp., has been promoted to manager of engineering and transferred to San Francisco.

W. R. Wyatt, assistant superintendent of Shell Oil Co.'s Sheridan, Tex., cycling plant, has been named superintendent of the company's Weeks Island, Louisiana, natural-gas and processing plant. A graduate of the University of Texas, Wyatt joined Shell in 1948.

Kelly H. Gibson, vice president in charge of production for Pacific Petroleums, Ltd., has been named executive vice president and a director of the company. Gibson was with British American Oil Co., Ltd., as production manager in Alberta and British Columbia before joining Pacific.

Lowell E. Anderson, Wyoming division chief engineer for Service Pipe Line Co., has been given a temporary assignment with Pan American Inter-

ANDERSON

CHRISTMAN

national Oil Co. in Argentina, where the company will build a pipeline for YPF, government oil agency. **Robert H. Christman,** section head in Service's Tulsa engineering department, will succeed Anderson as Wyoming division chief engineer. Anderson joined Service in 1947, Christman in 1946.

Dr. Charles L. Thomas, director of research and development for Sun Oil Co. since 1956, has been appointed scientific advisor, a new position. **Dr. Robert M. Kennedy,** associate director of research and development, will succeed Thomas as director.

T. W. Fisher, formerly superintendent of the Ventura, Calif., domestic producing district of Texaco, Inc., has been named division supervisor for industrial relations in Los Angeles. **O. W. Chonette,** division petroleum engineer, will succeed Fisher as Ventura district superintendent. **C. B. Scotty** will succeed Chonette.

John T. McDonnell, formerly Gulf Oil Corp.'s petrochemical sales representative in Houston, has been promoted to director of commercial plans. He will headquarter in Pittsburgh and will be responsible for developing long-range objectives and marketing plans for Gulf's petrochemicals. **Henry E. Redd,** Pittsburgh, will move to Houston as Gulf Coast area chemical marketing representative.

J. A. Tallant, rubber chemicals sales division coordinator for Phillips Chemical Co., has been appointed managing director of Phillips Carbon Black Co., Pty., a company recently formed by Phillips Petroleum Co. and Industrial Development Corp. of South Africa, Ltd. Tallant will headquarter in South Africa. The company's Port Elizabeth, South Africa, plant is scheduled for completion in 1961.

Horace Underwood, Amerada Petroleum Corp., has been elected president of New Mexico (East) Oil Scouts Association. **Don Schelde,** Union Producing Co., will be vice president. Other new officers are **Bill Craig,** Ohio Oil Co., secretary-treasurer; **Harold Palmer,** Honolulu Oil Corp., editor of the 1959 yearbook; and **Jerry House,** Lone Star Producing Co., assistant editor.

Stuart H. Nichols, president of Iroquois Gas Corp. and vice president of its parent company, National Fuel Gas Co., has been elected president of National Fuel Gas. He succeeds **William H. Locke,** who has retired. **Donald E. Conaway,** president of Pennsylvania Gas Co., a subsidiary, will succeed Nichols as vice president of National Fuel Gas. **Herbert D. Clay,** executive vice president of Iroquois Gas, will succeed Nichols as president of that company. **Louis R. Reif,** vice president of Iroquois, has been elected a director.

▶▶▶ Personals

D. A. Hardesty, general superintendent of pipelines for Houston Texas Gas & Oil Corp. and Coastal Transmission Corp., subsidiaries of Houston Corp., has been appointed superintendent of transmission for both companies. **Sid Windham,** division pipeline superintendent for

HARDESTY

WINDHAM

Coastal, will succeed Hardesty as general superintendent of pipelines for Coastal and Houston Texas Gas & Oil. Hardesty is a former vice president of Natural Gas Pipeline Co. of America, Texas-Illinois Natural Gas Pipeline Co., and Natural Gas Storage Co. of Illinois. Windham was assistant to the vice president of operations for Wilcox Trend Gathering System, Inc., before joining Coastal.

M. H. Standley, reservoir engineer, has been named Corpus Christi division reservoir engineer for Shell Oil Co.

G. H. Galny, formerly assistant manager of Continental Oil Co.'s headquarters geological section, Houston, has been promoted to division geologist in Durango, Colo. He succeeds **L. W. Heiny,** who has been named staff geologist in Houston.

J. Howard Olehy, general manager of manufacturing for Petroleum Chemicals, Inc., has been elected vice president. He will move to Lake Charles, La., from New Orleans. Also moving to Lake Charles from New Orleans will be **L. E. Taylor,** chief engineer, and **Paul Schaeffer,** purchasing agent.

F. G. Boucher, geophysical research division manager for Jersey Production Research Co. in Tulsa, has been given a temporary assignment as senior research associate and will carry out independent research. **Joseph F. Bayhi,** head of the geophysical engineering section, will temporarily replace Boucher. **R. L. Wilcox,** group head in the geophysical division, will succeed Bayhi. **Frank K. Levin,** group head, has been named research associate, geophysical section.

Personals

J. T. Higgins, assistant general manager of manufacturing for Standard Oil Co. of California, Western Operations, Inc., has moved up to vice president, a director, and general manager of manufacturing. He succeeds **Fred Powell,** who was recently named president of California Chemical Co. **N. T. Bogart,** formerly manager of operations at California Standard's El Segundo, Calif., refinery, will succeed Higgins as assistant general manager of manufacturing. Higgins has been with California Standard and its affiliates since 1929. He is a former president of Salt Lake Refining Co. and Salt Lake Pipe Line Co.

HIGGINS

J. S. Peerson, formerly in Sunray Mid-Continent Oil Co.'s Houston office, has been named Rocky Mountain division geologist in Denver. **Fred Goddard,** formerly in Corpus Christi, Tex., has been named Denver division production superintendent. Others moved to the new division office from Tulsa include **I. W. Pilkington,** division landman; **A. W. Wadman, Jr.,** log and reserves analyst; **J. G. Fletcher,** division office manager; and **Ed Faye,** lease records and contacts man. **Eugene E. Barr,** district geologist, and **James E. Renegar,** acting district landman, remain in Denver to head the district office there. **T. A. Clote,** formerly Tulsa division geologist, was recently named manager of the new Rocky Mountain division.

William D. Crews, Tulsa consultant, will be president of Exploration Unlimited, Inc., new Tulsa geophysical company. **Clarence E. Canady,** Tulsa geophysicist, has been named first vice president, and **John L. Dunn,** Tulsa attorney, is second vice president. The company will specialize in radioactivity surveys for domestic and foreign exploration.

Donald R. Merriman, vice president of Everglades Pipe Line Co., has been appointed assistant to the vice president of Buckeye Pipe Line Co. in New York. **Raymond L. Hirsch,** attorney for Buckeye, has been named assistant to the vice president in Lima, Ohio, by Buckeye. Everglade Pipe Line is a Buckeye affiliate.

Edd Turner, Tidewater Oil Co., has been elected 1959-60 president of Houston Geological Society. Outgoing president is **Dr. Ralph Taylor,** Humble Oil & Refining Co. **Ralph Davis,** Texaco, Inc., is the new first vice president, and **Curtis Franks,** Welex, Inc., is second vice president. Other new officers include **Austin Brixey,** Sinclair Oil & Gas Co., secretary, and **Henry Dean,** Tennessee Gas Transmission Co., treasurer. **Dr. Shirley Mason,** consultant; **Albert Tolbert,** Union Oil Co.; **Marion Roberts,** Humble; and **James Wheeler,** Howard & Wheeler, will be advisers.

Paul D. Balbin, chief geophysicist for Chaco Petroleum, S. A., Bolivian subsidiary of Tennessee Gas Transmission Co., has been promoted to general manager of Chaco. He will headquarter in Cochabamba, Bolivia. Balbin succeeds **W. B. Tapper,** who recently resigned. Balbin was with Pan American Petroleum Corp. before joining Chaco.

George W. Austin, Richfield Oil Corp. has been elected president of the Bakersfield, Calif., Landmen's Association. He succeeds **Robert H. Muir,** Superior Oil Co., who was recently transferred to Denver. **William D. Croghan,** Standard Oil Co. of California, will succeed Austin as vice president of the association.

H. W. Baker, assistant North Central Texas production district superintendent for Phillips Petroleum Co., has moved up to district superintendent. He succeeds **C. L. Montgomery,** who has taken early retirement. **C. D. Dohrer** will succeed Baker as assistant.

R. W. Sparks, chief engineer in the producing department of Texaco Canada, Ltd., has been promoted to manager, producing department. Sparks was operations manager of Halliburton Oil Well Cementing Co.'s Canadian subsidiary before joining Texaco Canada in 1954.

Deaths

Jacob N. Fell, 73, president of Fell & Wolfe Oil Co., Fell & Wolfe Investments, and the Bradford Cos., Tulsa supply firm, died July 5 in a Tulsa hospital after an illness of several months. Fell organized his supply company as Bradford Pipe & Supply Co. in 1919. It was consolidated with Bradford Pipelining in 1944. He organized Fell & Wolfe Oil in 1944 and the investment company 5 years ago.

David Alex Garrick, 48, president of Cherokee Labs, Inc., Tulsa; **William Gibson Wood,** 45, Cherokee Labs vice president; **Harry J. Richey,** 33, research director; and **Edward Fletcher Rogers,** 30, Tulsa attorney, were killed July 2 when their private plane crashed on a farm near Springfield, Mo. They were bound for a business conference in Indianapolis from Tulsa. Garrick's son, George, 11, was seriously injured in the crash.

Raymond H. Garvey, 66, Wichita, owner of the largest privately owned drilling company in Kansas, was fatally injured recently in a car-truck collision near McPherson, Kans. Garvey had extensive producing interests and a service-station chain.

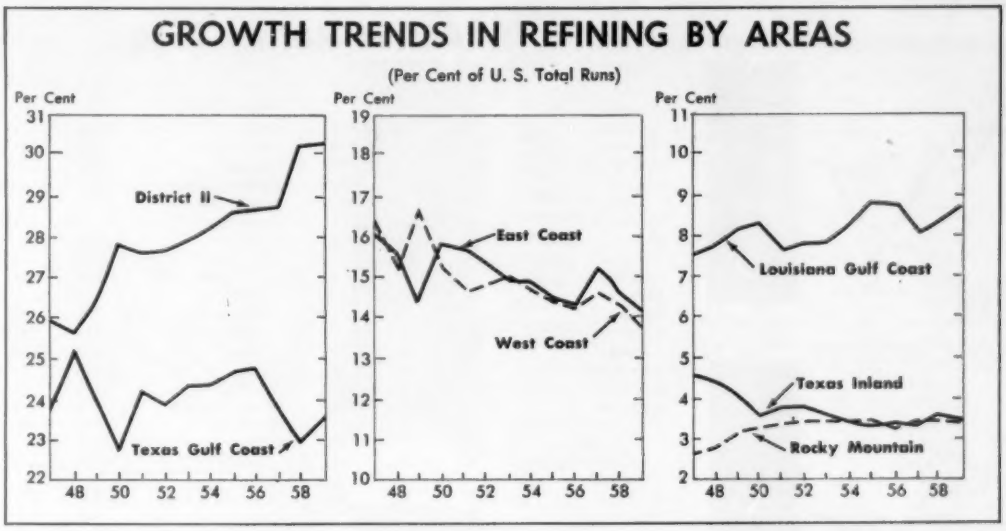
James Arthur Bennett, 79, Sapulpa, Okla., oil operator, died July 2 at his home after a heart attack. Two of Bennett's sons operate Bennett Drilling Co., Sapulpa.

The body of **Paul Fullop,** 38, partner in Eastern Petroleum Co., Denver, was recovered last week from the wreckage of his light plane which crashed May 27 on a flight from Denver to Farmington, N. M.

Edward G. (Pat) Sweeney, 67, Tulsa division sales manager for Buckeye Supply Co. of Kansas, Inc., died July 7 in Logan, Ohio. Sweeney joined Buckeye in 1942 in Zanesville, Ohio. He was district manager for the company in El Dorado, Kans., and division manager in Denver before moving to Tulsa in 1954.

Richard Dale Miller, 91, secretary-treasurer and a director of Universal Consolidated Oil Co. before his retirement last January, died July 7.

N. Barney Feagin, 79, owner and president of Feagin Investment & Oil Co., Tulsa, died July 2 in a Tulsa hospital. He had suffered a stroke earlier in the week. Feagin was with the old Guffey Petroleum Corp. in Beaumont, Tex., early in the century. He was later with Texaco.



Refinery growth changes may boost stock surpluses

BY JOHN C. CASPER

MAJOR PRODUCT STOCKS at mid-year were about 18 million barrels higher than at the same time last year. This much gain can't be justified on a basis of demand growth. Most refiners will agree that a product surplus is expensive and that last year's stock level would provide the required degree of safety for this year's expected demand.

Back about the middle of March this year, oil companies reporting to the Texas Railroad Commission said that the desired level for stocks of the four major products at the first of April is about 312 million barrels. By the first of November, stocks should rise to 396 million barrels, according to the reporting companies.

If stocks start at the required level on April 1 and rise at a constant rate to the required level for November 1, the total on July 1 will be a little less than 350 million barrels.

The stock gains probably would not form a straight line, but no normal seasonal stock curve could start at 312 million barrels in April, reach 398 million by the first of July and drop to 396 million by the first of November. Product stocks go up, not down, in the period from July 1 to November 1.

According to the yardstick supplied by the companies reporting to the commission, stocks were too high in April, too high at the first of July, and barring some forced reduction in runs will be too high in November.

High product-inventory levels are not unusual in the oil industry. Postwar supply caught up with demand in the summer of 1948, and the trend has been toward surpluses rather than shortages since that date.

These surpluses have been related to the postwar refinery growth pattern and to the loss of our export market.

The three charts above show the variations in growth of refinery runs by districts. A given point on a curve represents that district's per cent of total runs for the year.

Note that except for the Gulf Coast district of Louisiana, the important gains came from inland areas. Runs in District 2 accounted for only 25.55% of the national total in 1948 but climbed to a little over 30% by 1948. Louisiana Gulf Coast moved up 1.21 percentage points over the period, but Texas Gulf Coast ended last year about 0.67 percentage point below its position in 1947.

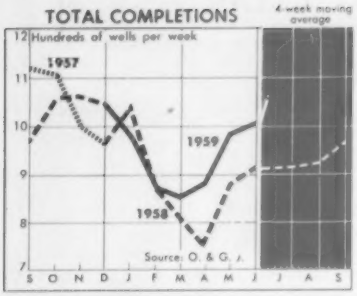
East Coast and West Coast districts had about the same volume of runs in 1947 and ended the period with nearly the same crude input. Both districts showed decreases relative to national totals. A refiner with changing markets may not shift runs to meet demand losses.

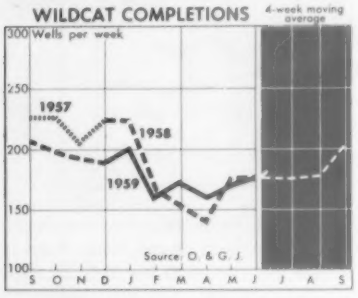
Inland Texas District's portion of runs decreased from 1947 through 1954 but has held steady since that time. The Rocky Mountain District, excluding New Mexico, climbed steadily through 1954 and had held about even with Texas Inland since that date.

This combination of shifts in growth patterns and changes in area demands has helped boost overproduction.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,907,335	DOWN	107,820	UP	432,381
Crude stocks	270,370,000	UP	4,641,000	UP	12,250,000
Completions	1,197	UP	169	UP	123
Refinery runs	7,936,000	UP	100,000	UP	475,000
Gasoline stocks	194,989,000	DOWN	3,282,000	UP	11,709,000
Kerosine stocks	27,529,000	UP	316,000	UP	3,075,000
Distillate stocks	121,179,000	UP	5,188,000	UP	14,608,000
Residual stocks	54,405,000	UP	565,000	DOWN	10,367,000
Pour-product stocks	398,102,000	UP	2,787,000	UP	19,025,000
Total imports	1,990,800	UP	342,300	UP	311,800





Active Rotary Rigs

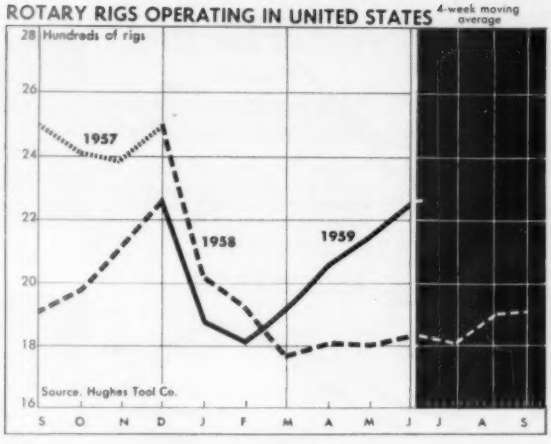
	7-6-59	6-29-59	7-7-58
Alabama	9	9	6
Arkansas	12	13	11
Arizona	2	2	0
California	101	100	77
Land	96	95	(*)
Offshore	5	5	(*)
Colorado	46	44	52
Florida	2	2	1
Land	1	1	1
Offshore	1	1	0
Illinois	36	47	46
Indiana	11	6	7
Iowa	2	3	3
Kansas	158	154	127
Kentucky	10	9	11
Louisiana	381	373	302
North	43	36	39
S. Inland waters	160	157	(†)
S. Land	125	128	219
Offshore	53	52	44
Maryland	0	0	0
Michigan	27	26	10
Mississippi	77	75	39
Missouri	1	1	1
Montana	24	23	18
Nebraska	36	34	25
Nevada	1	1	0
New Mexico	128	124	122
New York	1	1	2
North Dakota	20	27	34
Ohio	4	4	0
Oklahoma	243	242	204
Oregon	0	0	1
Pennsylvania	10	10	9
South Dakota	2	3	0
Tennessee	1	1	0
Texas	768	764	655
S. Inland waters	5	5	(†)
S. Land	194	203	127
Offshore	0	1	5
North-East	162	159	(*)
West Central	254	246	(*)
West	153	150	(*)
Utah	35	34	37
Washington	1	1	0
West Virginia	9	9	6
Wyoming	90	95	59
Total U. S.	2,248	2,237	1,865
Western Canada	137	139	134
Eastern Canada	0	0	3
Grand total	2,385	2,376	2,002

Hughes Tool Co. report. *Comparisons not available due to change in method of reporting. †Included in South-Land.

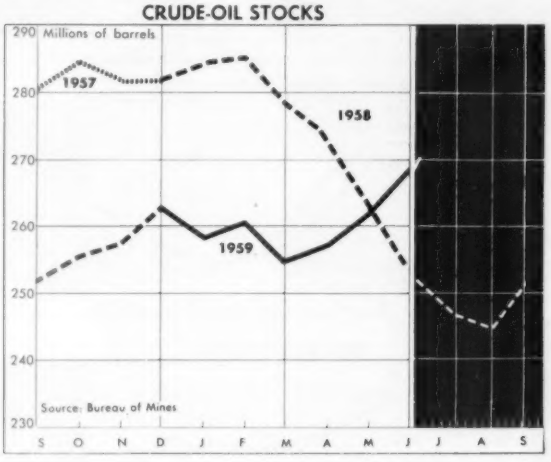
WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 4, 1959

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	2	1	0	0	1	0	24,181	49	41	1	0	0	0	1	10	16
Arkansas	17	7	0	1	9	0	74,971	416	336	5	1	0	0	4	68	86
California	25	16	0	0	9	0	93,732	767	870	4	0	0	0	4	176	179
Colorado	10	2	0	0	8	0	45,524	366	382	6	0	0	0	6	218	209
Illinois	34	10	0	0	15	9	81,104	1,048	1,023	0	0	0	0	0	167	206
Indiana	19	7	0	1	11	0	23,180	386	358	6	0	0	0	6	130	135
Kansas	27	16	0	0	10	1	92,354	1,986	1,879	0	0	0	0	0	443	391
Kentucky	115	99	0	0	13	3	53,873	1,273	512	2	0	0	0	2	75	59
Louisiana	66	30	7	3	25	1	527,965	1,780	1,699	11	1	0	0	10	224	245
North	19	8	0	3	8	0	101,508	642	592	7	1	0	0	6	93	84
South	36	17	7	0	11	1	323,695	944	880	4	0	0	0	4	124	145
Offshore	11	5	0	0	6	0	102,762	194	227	0	0	0	0	0	7	16
Michigan	17	8	0	0	9	0	56,938	310	197	5	0	0	0	5	73	69
Mississippi	8	3	0	0	5	0	71,020	320	198	4	0	0	0	4	150	99
Montana	7	3	0	0	4	0	40,182	148	184	3	0	0	0	3	53	81
Nebraska	23	11	0	0	12	0	136,877	412	350	7	2	0	0	5	180	168
New Mexico	44	29	1	5	9	0	177,237	955	979	7	1	0	0	6	116	125
West	22	12	1	5	4	0	57,657	428	460	3	0	0	0	3	35	54
East	22	17	0	0	5	0	119,580	527	519	4	1	0	0	3	81	71
New York	19	12	0	0	0	7	24,572	129	294	0	0	0	0	0	13	31
North Dakota	13	6	0	0	7	0	80,657	260	216	4	1	0	0	3	52	71
Ohio	29	17	0	1	10	1	82,530	491	512	1	0	0	0	1	14	5
Oklahoma	193	98	3	17	75	0	756,432	3,004	3,341	21	0	1	2	18	448	467
Pennsylvania	50	12	0	30	3	5	173,956	311	310	1	0	0	1	0	5	9
Texas	413	244	7	13	139	10	1,572,895	9,694	9,206	72	7	1	0	64	1,785	1,894
Dist. 1	31	11	0	1	19	0	51,133	582	517	9	0	0	0	9	162	2?9
Dist. 2	13	2	0	0	11	0	83,887	409	395	6	0	0	0	6	118	16?
Dist. 3	25	20	2	0	3	0	179,397	575	675	3	0	1	0	2	119	140
Dist. 4	16	4	2	3	7	0	95,328	657	632	2	0	0	0	2	160	185
East	37	28	1	0	8	0	133,718	567	619	3	0	0	0	3	117	178
Dist. 7-B	48	21	1	0	26	0	156,752	1,346	1,210	18	3	0	0	15	357	339
West	114	82	1	1	29	1	483,763	3,013	2,707	13	1	0	0	12	371	381
Dist. 9	92	51	0	4	28	9	246,513	1,854	1,810	14	3	0	0	11	322	306
Dist. 10	37	25	0	4	8	0	142,404	691	641	4	0	0	0	4	59	53
Utah	2	2	0	0	0	0	11,249	172	211	0	0	0	0	0	48	38
West Virginia	27	8	0	14	5	0	64,253	370	346	1	0	0	1	0	10	10
Wyoming	37	16	0	0	18	3	167,956	454	358	14	1	0	0	13	154	102
Miscellaneous	0	0	0	0	0	0	0	58	52	0	0	0	0	0	29	44
Total U. S.	1,197	657	18	85	397	40	4,433,638	25,159	23,854	175	14	2	4	155	4,641	4,739
Previous week	1,028	544	21	69	378	16	3,919,689	.....	.....	187	20	2	4	161	.....	.....
Cum. 1959	25,159	12,867	618	1,815	9,197	662	103,776,434	.....	.....	4,641	460	65	138	3,978	.....	.....
Cum. 1958	23,854	11,775	584	1,797	9,115	583	100,165,842	.....	.....	4,739	460	77	148	4,054	.....	.....
Western Canada	68	31	0	3	34	0	212,918	1,242	1,221	11	0	0	0	11	381	387
Ontario	16	0	0	8	8	0	17,376	102	.....	.....	.....	.....	.....	.....	.....	.....

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



DAILY AVERAGE PRODUCTION FOR WEEK

	July 4, 1959 Crude oil	Lease condensate	Total	June 27 total
Alabama	16,100	.....	16,100	16,050
Arkansas	81,050	250	81,300	81,250
California	848,100	.....	848,100	847,700
Colorado	124,100	.....	124,100	126,500
Eastern	40,800	.....	40,800	41,000
Florida	1,100	.....	1,100	1,300
Illinois	216,800	.....	216,800	214,900
Indiana	31,000	.....	31,100	30,700
Kansas	†306,175	.....	†306,175	†326,545
Kentucky	86,100	.....	86,100	85,300
Louisiana	874,325	98,500	972,825	972,225
North	110,400	5,000	115,400	114,725
South	763,925	93,500	857,425	857,500
Michigan	26,300	.....	26,300	26,300
Mississippi	126,775	4,275	131,050	130,825
Montana	78,600	.....	78,600	76,100
Nebraska	60,400	.....	60,400	62,800
Nevada	100	.....	100	100
New Mexico	288,425	3,800	292,225	293,300
North Dakota	35,000	.....	35,000	34,600
Oklahoma	519,700	.....	519,700	†541,300
Texas	2,503,000	76,675	2,579,675	2,646,625
Dist. 1	43,275	2,500	45,775	46,400
Dist. 2	104,575	7,900	112,475	117,200
Dist. 3	338,300	36,000	374,300	387,000
Dist. 4	173,275	8,500	181,775	186,800
Dist. 5	28,575	350	28,925	29,350
Dist. 6	105,575	6,500	112,075	115,500
East Texas Field	135,425	.....	135,425	141,000
Dist. 7-B	130,275	100	130,375	132,100
Dist. 7-C	118,150	3,225	121,375	125,625
Dist. 8	1,014,575	3,800	1,018,375	1,052,000
Dist. 9	205,000	1,800	206,800	206,800
Dist. 10	106,000	1,000	107,000	106,850
Utah	114,700	.....	114,700	116,800
Wyoming	344,900	.....	344,900	342,800
Others	‡185	.....	‡185	‡135
Total U. S.	6,723,835	183,500	**6,907,335**	7,015,155
Change from prev. week, down	.....	.....	**107,820**	.....
Canada	†467,900	.....	†467,900	†517,600

Total U. S. Production—Jan. 1-July 4 ..... 1,326,895,015 bbl.
Same period last year (crude plus cond.) ..... *1,195,918,810 bbl.

*Includes 30,209,800 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota and Washington.

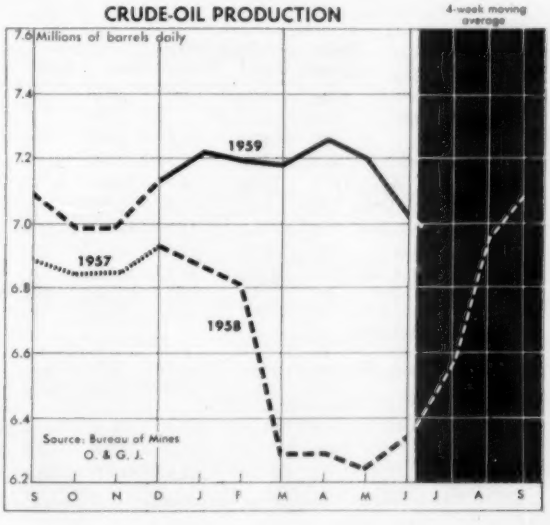
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	6-27-59	6-20-59	6-28-58
Pennsylvania	2,466	2,453	2,887
Other Appalachian	2,093	2,031	1,358
Illinois, Indiana, Michigan	9,582	9,524	11,334
Nebraska and North Dakota	2,996	2,821	2,096
Kansas	10,524	10,680	10,345
Oklahoma	16,942	16,497	17,024
Arkansas	1,954	2,089	2,323
Louisiana	19,461	18,550	16,030
North	3,146	3,083	2,867
South	16,315	15,467	13,163
Mississippi, Alabama, Florida	2,391	2,431	2,050
New Mexico	8,111	8,325	6,529
Texas	116,461	115,415	106,623
East Texas	9,277	9,610	7,385
West Texas	55,615	54,894	50,292
Texas Gulf	18,945	18,724	21,189
Other Texas	32,624	32,187	27,757
Wyoming	16,363	16,330	15,863
Other Rocky Mountain	9,537	9,690	8,248
California	32,862	32,376	39,438
Foreign	†18,627	16,517	15,972
Total	**270,370**	265,729	258,120

*Bureau of Mines. †Includes 4,386,000 bbl. in California.

CRUDE-OIL PRODUCTION



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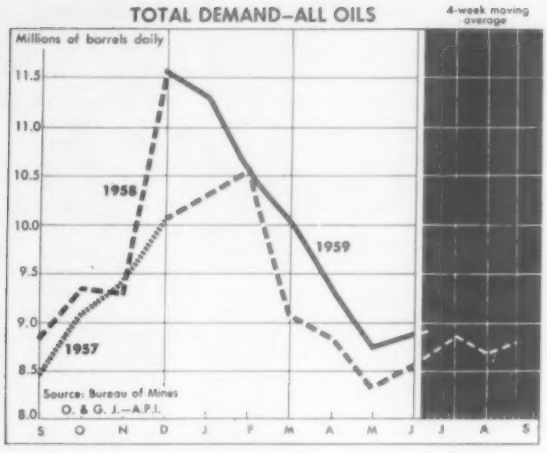
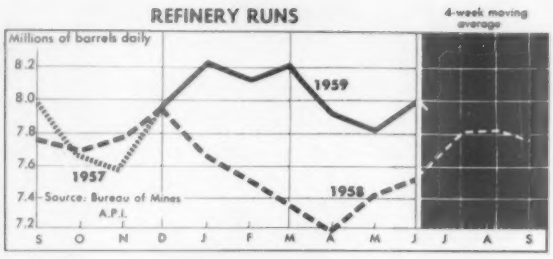
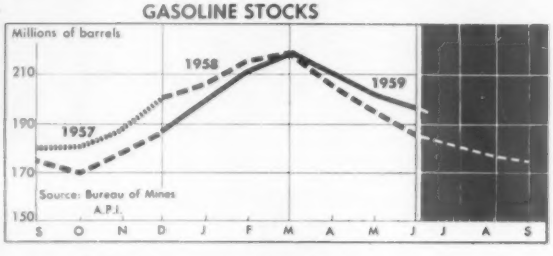
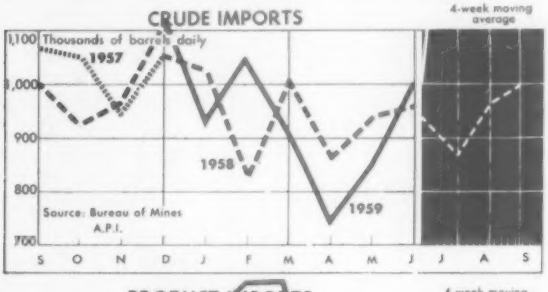
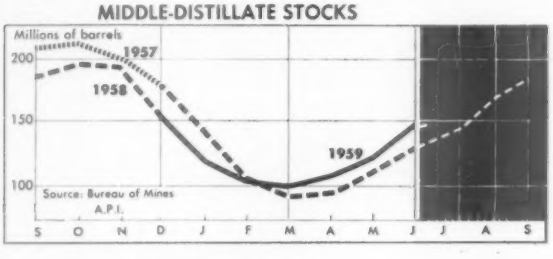
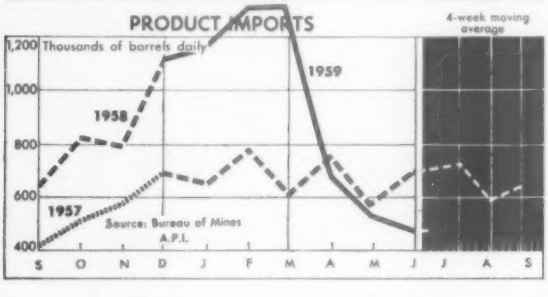


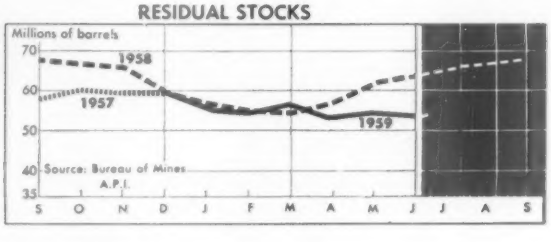












API REFINERY REPORT—JULY 3, 1959
(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July, 1958—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,088	503.0	19.7	301.9	191.4	45,127	10,007	42,180	12,442	1,093	497.9	20.1	285.4	171.9
Appalachian:														
Dist. 1	98	41.6	3.3	21.4	6.1	5,506	573	2,591	301	94	42.2	2.5	21.6	5.8
Dist. 2	111	46.9	5.6	22.4	9.6	2,635	536	1,186	163	108	55.4	5.7	17.3	7.3
Ind., Ill., Ky.	1,477	751.4	64.1	309.1	181.7	34,789	5,823	19,834	4,092	1,373	718.9	60.3	265.0	124.5
Minn., Wis., Dak.	113	52.7	2.4	28.3	11.1	6,604	951	4,938	375	109	53.0	5.7	28.4	10.0
Okla., Kans., Mo.	751	408.1	13.3	188.7	15.9	17,908	1,259	8,568	686	742	416.4	12.5	174.9	25.5
Inland Texas	293	210.8	12.6	43.6	17.6	7,158	359	1,511	2,038	272	192.9	5.3	45.3	18.2
Texas Gulf Coast	1,730	832.6	84.2	454.4	138.0	24,668	3,815	15,521	5,429	1,633	839.3	68.4	382.6	178.6
La. Gulf Coast	744	399.3	38.3	177.6	42.2	11,157	2,787	6,528	1,439	613	362.0	38.2	149.2	45.0
N. La. and Ark.	97	45.3	5.7	23.3	3.9	4,190	634	2,321	154	100	41.7	4.3	25.5	6.6
Rocky Mountain:														
New Mexico	25	10.9	0.3	5.3	3.4	735	48	162	109	27	13.5	0.5	5.1	2.5
Other Rocky Mt.	308	134.0	0.3	72.0	30.3	5,440	302	2,537	1,063	294	134.6	3.5	61.1	30.7
West Coast	1,101	478.0	5.6	176.0	303.4	29,072	435	13,302	26,114	1,069	485.6	5.6	150.0	284.8
July 3, 1959	7,936	3,914.6	255.4	1,824.0	954.6	194,989	27,529	121,179	54,405	7,527	3,853.4	232.6	1,611.4	911.4
June 26, 1959	7,836	4,097.4	251.6	1,783.9	969.4	198,271	27,213	115,991	53,840	.....	.....	.....	.....	.....
July 4, 1958	7,461	3,897.4	261.6	1,589.7	960.4	183,280	24,454	106,571	64,772	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (89 octane)	10.875-11.25
★ Premium (99 octane)	13.625-14.25
Gulf Coast (cargoes for coastwise or export movements):	
★ Regular (90 octane)	10.25-10.375
★ Regular (92 octane)	10.50-10.625
★ Premium (98 octane)	11.625-11.75
California (rack) (Los Angeles):	
Regular (88 octane)	12.50
Premium (94 octane)	13.50
Premium (100 octane)	15.00
Caribbean area (cargoes):	
Regular (87 octane)	9.875
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.25-9.75
Diesel oil (58 d.i. and above)	9.00-9.50
Distillate No. 1	9.00-9.50
Distillate No. 2	8.25-8.75
Gulf Coast (cargoes):	
Kerosine 41-43	8.375-8.50
Distillate No. 2	8.00-8.25
New York Harbor (barges):	
Kerosine 41-43	9.90
Distillate No. 2	9.40
Diesel fuel, 48-52 d.i.	9.65
Caribbean area (cargoes):	
Distillate No. 2	8.25

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank car	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.85-2.00
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.49	....	$2.35	2.06
21-21.9	2.50	2.52	....	2.38	2.11
22-22.9	2.60	2.55	....	2.41	2.16
23-23.9	2.69	2.58	$3.44	2.44	2.21
24-24.9	2.78	2.61	3.46	2.47	2.26
25-25.9	2.84	2.64	3.48	2.50	2.31
26-26.9	2.90	2.67	3.50	2.53	2.36
27-27.9	2.95	2.70	3.52	2.56	2.49
28-28.9	3.01	2.73	3.54	2.59	2.54
29-29.9	3.07	2.76	3.56	2.62	2.59
30-30.9	3.12	2.79	....	2.65	2.63
31-31.9	3.20	2.82	....	2.68	2.67
32-32.9	3.27	2.85	....	2.71	2.71
33-33.9	3.34	2.88	....	2.74	2.75
34-34.9	3.41	2.91	....	2.77	2.79
35-35.9	3.47	2.94	....	2.80	2.83
36-36.9	3.52	2.97	....	2.83	2.87
37-37.9	3.56	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 4-1-59.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.25
Middle District	4.07
Southwest Pennsylvania	3.80
West Virginia	3.62
Buckeye Grade	3.47
Illinois Basin	3.00

FOREIGN

Canada:	
Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41-9°, Puerto La Cruz	3.08-3-10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° very 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-Hawaii, clean (ATRS—40%)	$5.28
★ Carib.-Sweden, dirty (Scale—60%) (17s. 5d.)	2.45
★ PG-Turkey, clean (USMC—50%)	3.78
★ PG-Portland, dirty (Scale—70%) (24s. 3d.)	3.42

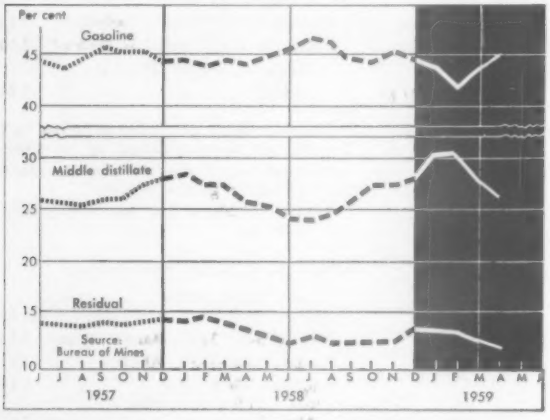
SELECTED MONTHLY DATA

SUPPLY AND DEMAND—MAJOR PRODUCTS
(Thousands of barrels daily)

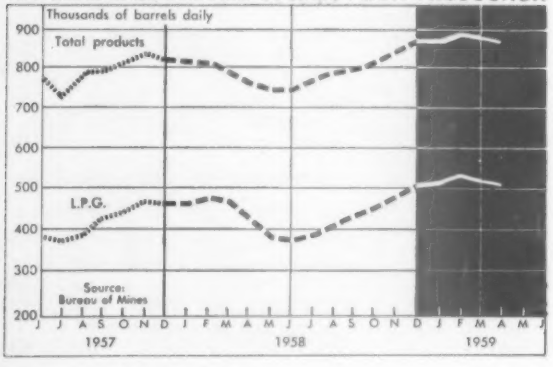
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
June 1959*	4,340	4,075	197,000
May 1959*	4,225	3,944	203,200
April 1959	4,239	3,937	210,395
July 1958	4,303	4,017	180,705
June 1958	4,251	3,896	186,276
KEROSINE			
June 1959*	155	265	27,500
May 1959*	136	264	24,500
April 1959	200	276	21,003
July 1958	180	249	25,655
June 1958	145	254	24,167
DISTILLATE			
June 1959*	1,140	1,800	119,700
May 1959*	1,330	1,745	99,650
April 1959	1,621	1,739	86,222
July 1958	1,256	1,750	119,437
June 1958	1,115	1,773	105,311
RESIDUAL			
June 1959*	1,400	950	53,600
May 1959*	1,404	930	54,500
April 1959	1,590	937	53,327
July 1958	1,315	981	66,457
June 1958	1,209	912	63,864

*Preliminary. †Thousands of barrels.

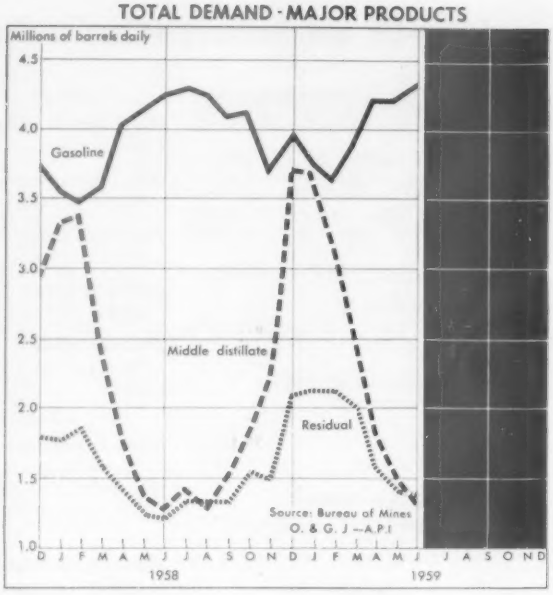
REFINERY YIELDS



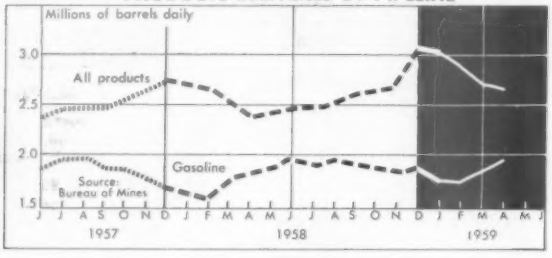
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



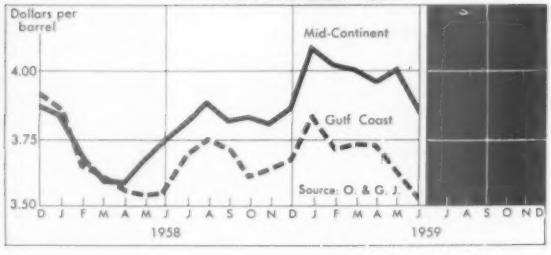
TOTAL DEMAND - MAJOR PRODUCTS



PRODUCTS DELIVERED BY PIPELINE



REFINERY REALIZATION



REFINERY REALIZATION

	June* 1959	May* 1959	Apr. 1959	June 1958
Mid-Continent	$3.85	$4.01	$3.96	$3.74
Gulf Coast	3.53	3.61	3.73	3.54

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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Details of the lease offering and filing of bids may be obtained by addressing an inquiry to the General Superintendent, Navajo Indian Agency, attention: Branch of Realty, Window Rock, Arizona.

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UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D.C. Notice is hereby given that approximately 39.70 acres of land within the known geologic structure of Monroe gas field, Louisiana, will be offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 1:00 p.m., E.S.T., August 5, 1959, when bids will be opened. Full details of the lease offering, and how and where to submit bids, may be obtained from the Manager, Eastern States Land Office, Bureau of Land Management, Washington 25, D. C. H. K. Scholl, Manager.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Blackfeet Indian Agency, Browning, Montana. Sealed Bids will be received until 2:00 P. M., Mountain Standard Time, August 12, 1959 and opened at that time in the office of the Superintendent, Blackfeet Indian Agency, Browning, Montana for leasing of 5,613.01 acres of Tribal land, 8,243.63 acres of allotted land and 160.00 acres of land in which the Tribe and individual allottees have combined interests, located in Townships 36 North, Range 6 West; 35 North, Range 7 West; 35 North, Range 6 West; 31 North, Range 9 West; 30 North, Range 8 West, Glacier County and Township 29 North, Range 8 West in Pondera County, Montana for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Blackfeet Indian Agency, at Browning, Montana.

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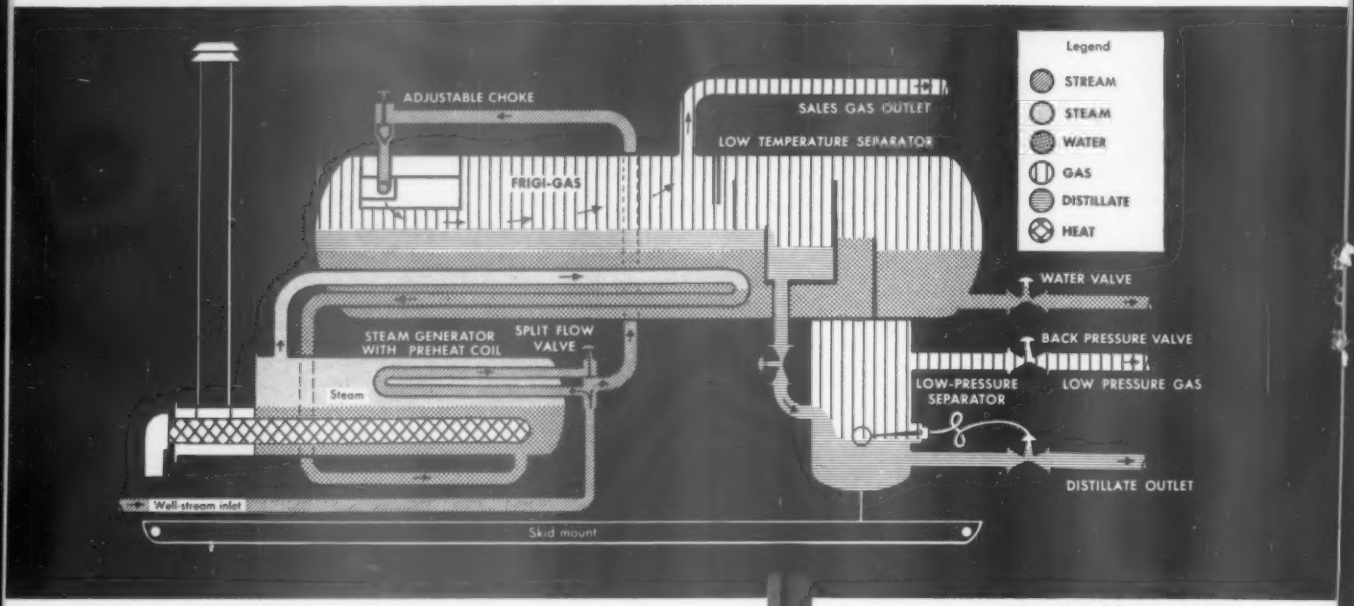
They're New NATIONAL® FRIGI-GAS UNITS



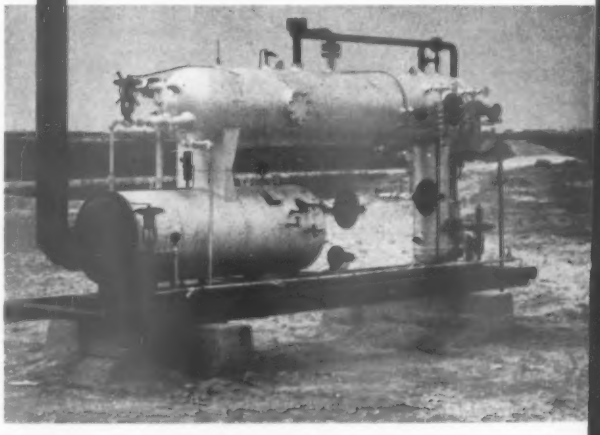
National designed this distinctly new and improved method for handling high to moderate pressure distillate wells, particularly when flow rate requirements vary over a wide range of operations, i.e. rates from one tenth (1/10) of a million per day up to rated recommended capacities, with ability to care for wide differences of throughput during the same 24 hour period.

The National Frigi-Gas Unit consists of a low temperature oil-gas-water separator with steam-heated base, choke and automatic controls; a steam generator with preheat coil; a low-pressure flash separator with automatic controls and all piping, valves, gages, skids, safety features and all other accessories.

- Single heat source
- Low operating temperature
- Produces clean, dry gas
- Disposes of water separately
- Maximum liquid recovery at lowest attainable separation temperature
- Collects distillate separately
- Will handle larger quantities of paraffin, drilling mud and other foreign substances than conventional designs
- Another "PACKAGED UNIT" by National

Patented and Patents Pending

For High, Low, Medium flow rates for the separation of gas, water, and distillate at/-or below hydrate temperatures especially at varying flow rates.

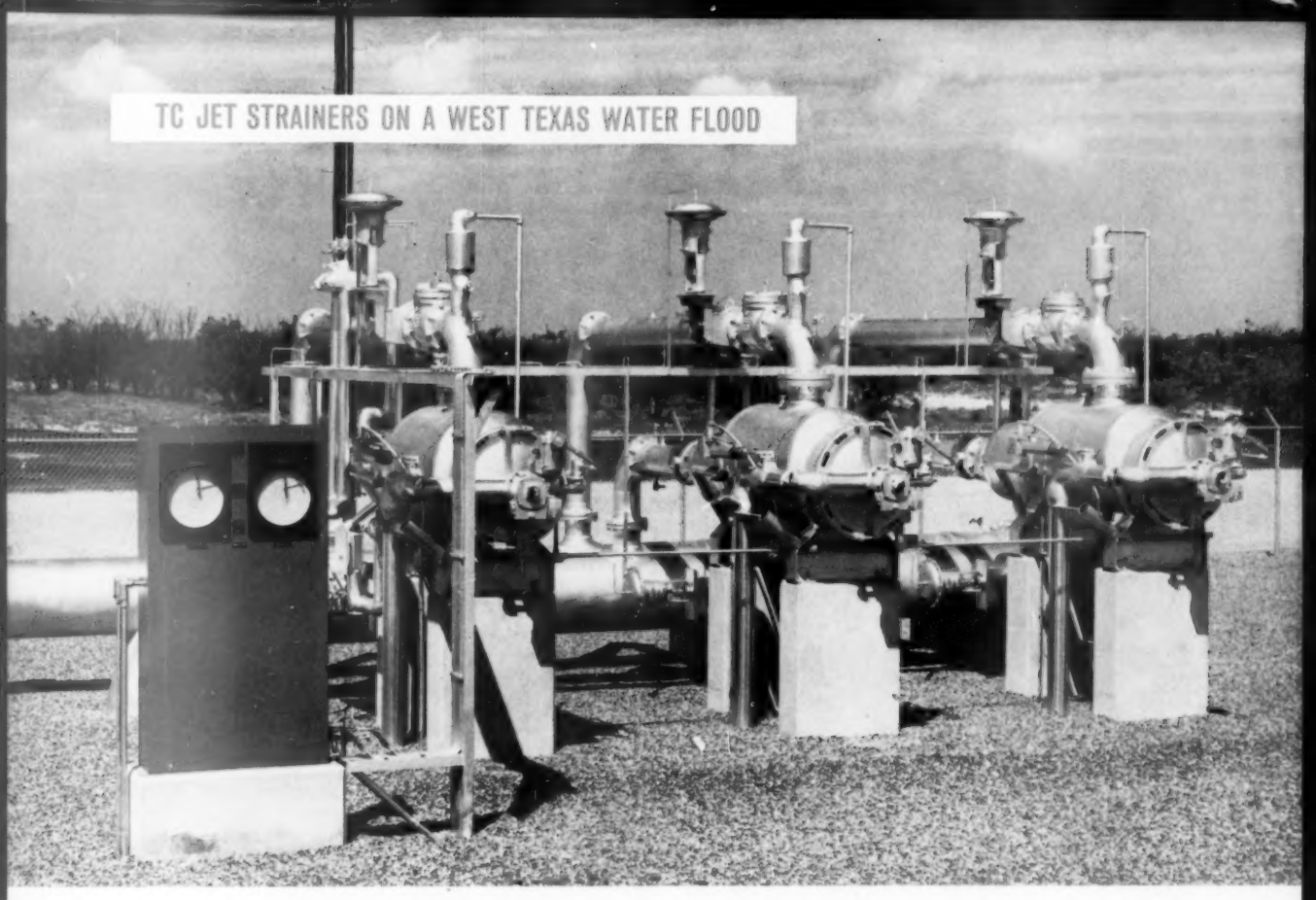


National can handle all your gas production problems from the Wellhead to the Consumer

It's a National®

NATIONAL TANK COMPANY

TULSA, OKLAHOMA



The One Sure Way to Clean Up Injection Flood Water

There's a big difference in water filtration equipment. Here, for example, are three small, compact, T-C Self-Cleaning Jet Strainers with a huge capacity for handling injection flood water. But best of all, these strainers require little attention, even less maintenance expense. In fact, their operation is fully automatic. They clean themselves when the baskets become dirty. At a predetermined pressure-differential across the basket, rotating jets go into action and scour the baskets clean. The entire cleaning operation takes only a few minutes.

T-C Jet Strainers are available in 10H, 20H and 30H sizes. 100, 200, and 400 mesh screens are interchangeable, depending on the particle size of sand and solids to be removed from the water. Extremely fine filtration, down to sub-micron particle size—including algae and bacteria—can be obtained easily with the aid of a diatomaceous earth coating on the basket.

If you attach importance to the cleanliness of your flood water—and most operators do—you should know all about T-C Jet Strainers. A brochure will gladly be sent on request.

An over-all view of a water filtration installation near Odessa, Texas. The three Model 30-H, T-C Self-Cleaning Jet Strainers are shown in the close-up above and at far right in this picture.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

HUGHES SERVICE can help you cut drilling costs

■ As an example, take the cases of companies drilling deep wells in the Gulf Coast area and an operator drilling shallow wells in Oklahoma:

The companies drilling in the Gulf Coast were having great difficulty in penetrating certain porous formations. Occasionally, they were able to make only a few feet a day.

Hughes engineers were consulted because of the company's extensive high pressure drilling research in which conditions existing in deep wells were simulated. Operating changes made as a result of the joint analysis of the problems by the Hughes engineers and the operators resulted in greatly reducing the drilling time of the deep wells. The savings to the operators amounted to several hundred thousand dollars.

The Oklahoma operator was drilling in a shallow field near Perry. He had lowered his costs to what he considered rock bottom, but decided to let Hughes develop an *engineered bit program* for his next well. This included recommending the types of bits to be run, weight, r.p.m., and hydraulics. The result: reduction of drilling time from 206 hours to 166 hours, with fewer bits. The saving, $1880.

In between the two extremes are scores of cases of substantial savings made by operators who have followed HUGHES *engineered bit programs.* This service is available to all operators . . . in all fields . . . for the asking. It is based on the industry's greatest rock bit experience and on the industry's most extensive and consistent research.

That's why we can say that Hughes *Service* and Hughes *Bits* make an unbeatable combination.

HUGHES TOOL COMPANY

50TH ANNIVERSARY YEAR 1909 – 1959